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REXCR 2 ROTORCRAFT SIMULATION MODEL VOLUME III USER'S MANUAL

**J. S. Reaser,
P. H. Kretsinger**

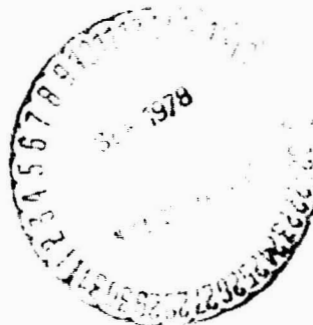
**LOCKHEED-CALIFORNIA CO.
P.O. BOX 551
BURBANK, CALIF. 91520**

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16. ABSTRACT This report describes a rotorcraft nonlinear simulation called REXOR II, and is divided into three volumes. The first volume is a development of rotorcraft mechanics and aerodynamics. The second is a development and explanation of the computer code required to implement the equations of motion. The third volume is a user's manual, and contains a description of code input/output as well as operating instructions.					
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FOREWORD

This report describes a nonlinear rotorcraft model and associated computer software which has been developed and documented for NASA, Langley Research Center, Hampton, Virginia under contract NAS1-14570 (July 1976). This work has been performed by the Lockheed-California Company, Burbank, California.

P. H. Kretsinger (Lockheed) performed the software implementation. W. D. Anderson and Fox Conner (both of Lockheed) assisted in preparation of the program.

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REXOR II ROTORCRAFT SIMULATION MODEL*

Volume III User's Manual

J. S. Reaser and P. H. Kretsinger

Lockheed-California Company

SUMMARY

This report describes a generalized format rotorcraft nonlinear simulation called REXOR II. The program models single main rotor vehicles with up to seven main rotor blades. Wings, two horizontal tail planes, and auxiliary thrustors may be included to model a variety of compound helicopter configurations.

Program output is primarily in the form of machine plotted time histories specified from a signal list. This list is, in turn, user selected from a set of computation variables used by the program.

LIST OF SYMBOLS

The symbols used in REXOR II are quite numerous. In order to keep the list to manageable proportions a list of basic symbols is given, followed by subscripts, superscripts, and postscripts. Nonconforming cases of usage together with complicated or obscure subscripting are fully annotated in the basic list.

SYMBOLS

a	arbitrary vector
a_s	speed of sound, m/s
$\ddot{a}_0$	acceleration vector, m/s (ft/s ²)
a_1	longitudinal component of blade first harmonic flapping, rad
$[A]$	generalized mass element matrix
$A_{1,2,3}$	modal variables
A_{1n}	generalized displacement of <u>nth</u> blade, first mode

*The contract research effort which has lead to the results in this report was financially supported by USARTL (AVRADCOM) Structures Laboratory.

A_{2n}	generalized displacement of nth blade, second mode
A_{3n}	generalized displacement of nth blade, third mode
A_{1S}	cosine component of blade first harmonic cyclic, rad
b	number of main rotor blades; arbitrary vector
B	dissipation function
B_{1S}	sine component of blade first harmonic cyclic, rad
c	blade segment chord, m (ft)
$[c]$	damping matrix .
C_D	aerodynamic drag coefficient
C_L	aerodynamic lift coefficient
C_M	aerodynamic pitching moment coefficient
C_P	power coefficient
C_T	thrust coefficient
$C_{X,Y,Z}$	linear damping, N/m/s (lb/ft/s)
$C_{\phi,\theta,\psi}$	rotary damping, N-m/rad/s (ft-lb/rad/s)
$C_{1,2,3}$	blade bending to feathering couplings
$C(k)$	lift deficiency function
d	infinitesimal increment
dr	increment in rotor, radius, m (ft)
dt	increment in time
d/dt	derivative with respect to time
$(d/e)_0$	swashplate to feather gear ratio, zero collective
$(d/e)_1$	swashplate to feather gear ratio slope with collective
e	pitch horn effective crank arm, m (ft)
EI	blade bending stiffness distribution, N-m ² (lb-ft ²)
f_{iMR}	ground effect factor for main rotor

F	factor; force, N (lb)
$F_{X,Y,Z}$	force components along X,Y,Z directions, N (lb)
$F_{\phi,\theta,\psi}$	generalized force about ϕ, θ, ψ axis
$F_{\beta PH}$	feathering mode generalized force
g	gravity, m/s^2 (ft/s ²)
$g_{X,Y,Z}$	gravity components along X,Y,Z directions
G	gear ratio
$\{G\}$	generalized force vector
$\ddot{G}$	gyro angular acceleration partial product
GJ	blade torsional stiffness, N-m ² (lb - ft ²)
I_X	$= \sum m_i X_i^2, kg-m^2$ (slug-ft ²)
I_Y	$= \sum m_i Y_i^2, kg-m^2$ (slug-ft ²)
I_Z	$= \sum m_i Z_i^2, kg-m^2$ (slug-ft ²)
I_{XX}	$= \sum m_i (Y_i^2 + Z_i^2), kg-m^2$ (slug-ft ²)
I_{YY}	$= \sum m_i (X_i^2 + Z_i^2), kg-m^2$ (slug-ft ²)
I_{ZZ}	$= \sum m_i (X_i^2 + Y_i^2), kg-m^2$ (slug-ft ²)
I_{XY}	$= \sum m_i X_i Y_i, kg-m^2$ (slug-ft ²)
I_{XZ}	$= \sum m_i X_i Z_i, kg-m^2$ (slug-ft ²)
I_{YZ}	$= \sum m_i Y_i Z_i, kg-m^2$ (slug-ft ²)
i	unit vector
j	unit vector
J	advance ratio
k	number of blade radial stations; reduced frequency, rad/s; unit vector
$[K]$	spring matrix
K_{mj}	blade spring matrix element

$K_{X,Y,Z}$	spring constants along X,Y,Z direction, N/m (lb/ft)
$K_{\phi,\theta,\psi}$	spring rates about ϕ, θ, ψ axis, N-m/rad (ft-lb/rad)
l_{IB}	location inboard feather bearing, m (ft)
l_{OB}	location outboard feather bearing, m (ft)
l_p	radial location of intersection of precone and feather axis, m (ft)
L	rolling moment, N-m (ft-lb)
m	mass of element, kg (slugs)
m_F	summed fuselage coordinate mass, kg (slugs)
m_H	summed hub axis mass, kg (slugs)
m_i	mass of <u>ith</u> particle or blade segment, kg (slugs)
m_{SP}	swashplate summed mass, kg (slugs)
M	pitching moment, N-m (ft-lb); $= \sum m_i$, kg (slugs); mach number
$[M]$	generalized mass matrix
M_{rk}	generalized mass matrix element
$\overline{M}_X$	$= \sum m_i X_i$, kg-m (slug-ft)
$\overline{M}_Y$	$= \sum m_i Y_i$, kg-m (slug-ft)
$\overline{M}_Z$	$= \sum m_i Z_i$, kg-m (slug-ft)
$M_{X,Y,Z}$	moments about X,Y,Z axis, N-m (ft-lb)
M_ϕ	blade torsional moment, N-m/m (ft-lb/ft)
N	number of system particles
p	angular velocity about X axis, rad/s; particle
P_{iMR}	main rotor pitch moment inflow, m/s (ft/s)
q	generalized coordinate; angular velocity about Y axis, rad/s

q_{iMR}	main rotor roll moment inflow, m/s (ft/s)
Q	generalized forcing function
q_A	aerodynamic pressure times reference wing area, kg (lb)
Q_{LOADS}	total nonmain rotor aerodynamic loads matrix
Q_{TR}	tail rotor torque, N-m (ft-lb)
r	general vector; radius of curvature, ft; angular velocity about Z axis, rad/sec; notation for (X,Y,Z)
r_S	static blade shape
R	vector displacement of particle p in X,Y,Z axis system
R_0	vector displacement of x,y,z origin in X,Y,Z system
$R_{Z\phi,Z}$	gyro damper coupling ratios
S	Laplace variable, path of motion of particle p
S_{HA}	blade spline length along neutral axis locii, m (ft)
t	time
T	kinetic energy, N-m (ft-lb)
$[T]$	transformation of coordinates matrix
u	velocity in X direction, m/s (ft/s)
U	potential energy function, N-m (ft-lb); strain energy, N-m (ft-lb)
$U_{C,P,S,T}$	air velocity on blade element, m/s (ft/sec)
v	velocity in Y direction, m/s (ft/sec)
V_T	trajectory velocity
w	velocity in Z direction, m/s (ft/sec)
w_{iMR}	main rotor collective inflow, m/s (ft/sec)
w_{iTR}	tail rotor collective inflow, m/s (ft/sec)
x	motion in X direction, m (ft); blade span location

X	coordinate direction; axis; deflection, m (ft); location, m (ft); cross product
X_{SW}	blade radial station of sweep and jog, m (ft)
X_T	trajectory path, m (ft)
X_{TR}	tail rotor longitudinal force, m (lb)
y	motion in Y direction, m (ft)
Y	coordinate direction; axis; deflection, m (ft); location, m (ft)
$Y_{TTO1,2,3}$	tension torsion pack outboard end modal coefficients
Y_{ONA}	difference between Y direction locations of cg and neutral axis points of blade element, m (ft)
z	motion in Z direction
Z	coordinate direction; axis; deflection, m (ft); location, m (ft)
Z_{SP}	relative swashplate vertical displacement with respect to the hub, m (ft)
$Z_{TTO1,2,3}$	tension-torsion pack outboard end modal coefficients
Z_{OBL}	teetering rotor undersling, m (ft)
Z_{OF}	hub set distance above fuselage set, m (ft)
Z_{OSP}	hub set distance above swashplate set, m (ft)
α	angle of attack, rad
α_2	angle of attack with hub set, rad
β	sideslip angle, rad
β_{FA}	blade feathering angle, rad
β_{PHn}	feathering/pitch-horn bending or dynamic torsion generalized coordinate displacement
β_0	blade droop relative to precone angle, rad

γ	blade sweep angle, rad; dynamic stall delay, s
γ_T	trajectory path angle with E set, rad
δ	limit deflection, rad; freeplay, rad; small increment
δ_{3TR}	tail rotor pitch - flap coupling
$\partial \epsilon / \partial \alpha$	downwash factor of wing on horizontal tail
ζ	vector notation of ϕ , θ , ψ
θ	rotation about Y axis, rad
θ_0	collective blade angle, rad
λ	sideslip at blade element, rad
ρ	air density, kg/m^3 , (slugs/ft ³)
τ	time constant, s; natural period, s
τ_0	feathering axis precone, rad
ϕ	rotation about X axis, rad
ϕ_F	feathering angle, rad
ϕ_{Fn}	feathering angle of blade element of <u>n</u> th blade, rad
ϕ_{REF}	blade root reference feather angle, rad
ϕ_T	blade torsion, rad
ϕ_T	sum of blade twist and torsion, rad
χ_{IMR}	wake angle of main rotor, rad, (deg)
ψ	rotation about Z axis, rad; sideslip angle with hub set, rad
ψ_c	control input axis rotation from swashplate, rad
ψ_{PH}	pitch lead angle, rad, (deg)
ψ_T	trajectory path yaw with E set, rad
ψ_w	main rotor apparent airflow angle, rad
ω	rotational speed, rad/s; angular velocity, rad/s; natural frequency, rad/s

partial derivative, derivation

SUBSCRIPTS

a	arbitrary coordinate set a
A	due to aerodynamics
b	arbitrary coordinate set b
BEND	associated with blade elastic bending
BLE	blade element coordinate system
BL _n	blade reference axis system for the <u>n</u> th blade
C	associated with pilot control input, chordwise
CG	associated with center of gravity location
CORR	corrective, correction
DW	referring to downwash
DYN	referring to dynamic component
E	earth axis
ENG	associated with powerplant - engine
EST	estimated
F	fuselage axis; associated with blade feathering
FA	referring to blade feather axis
FB	associated with feedback
F _n	associated with feathering of the <u>n</u> th blade
FR	due to friction
G	referring to gyro or gyro coordinate system
GEN	associated with gas generator section of powerplant
GFB	associated with gyro control feedback
GSP	gyro to swashplate connection

GUB	relating to gyro gimbal unbalance
H	referring to hub or principal reference axis system
HT	associated with horizontal tail
i	referring to inflow, particle
IB	referring to inboard feather bearing location
J	spring matrix index
Jog	associated with blade attachment joggle
J	associated with gyro end of feedback rod linkage
Jn	associated with feedback rod coming from the <u>n</u> th blade
k	generalized mass index
LAG	associated with lead-lag damper
LIMIT	signifying limiting value
m	blade mode index, spring matrix index
MR	associated with main rotor
n	blade number index
NA	referring to blade segment neutral axis
NEW	newly determined value
NO	normal (to airflow) component
NR	pertaining to nonrotating value
OB	referring to outboard feather bearing location
OLD	value from previous time step
P	associated with propeller; perpendicular blade component
PH	referring to pitch horn
r	generalized mass index
R	referring to rotor axis system

REF	associated with blade feather reference value
RH	referring to control gyro feedback lever moment
S	referring to blade spanwise velocity; general mode; static; structural; shaft
SC	referring to blade segment shear center
SP	referring to swashplate
SP _c	command to swashplate
S, SP	referring to swashplate limit stop
STEADY	steady component
SW	referring to blade sweep angle location
T	associated with trajectory path relating to E axis; tangential blade component; blade torsion; blade twist
TR	associated with the tail rotor
TRIM	initial or trim value
TW	associated with blade twist (built in)
UB	relating to control gyro unbalance
UNSTEADY	associated with unsteady component
VT	associated with vertical tail
WING	associated with the wing
X	relating to component in X direction
Y	relating to component in Y direction
YA	relating to aerodynamic component in Y direction
Z	relating to component in Z direction
ZA	relating to aerodynamic component in Y direction

0	(nought) associated with collective value, coordinate axis value, with respect to principal reference axis, blade root summation
1,2,3	with respect to blade modes 1, 2, or 3
1S	first harmonic component shaft axis feathering
1/4 c	with respect to blade 1/4 chord
3/4 c	with respect to blade 3/4 chord
B_{PHn}	associated with the feathering mode of the <u>n</u> th blade
ϕ	relating to component in the ϕ direction
θ	relating to component in the θ direction
ψ	relating to component in the ψ direction

SUPERSCRIPTS

I	referring to inertial reference
T	matrix transpose
(-)	(bar) average quantity
(')	(prime) slope with respect to blade span
(.)	(dot) time derivative of basic quantity
(..)	(double dot) second time derivative
(-1)	matrix inverse
(→)	vector quantity

POSTSCRIPTS

(i)	blade radial station index
(n)	blade number index

1. INTRODUCTION

1.1 Contents of Manual

Volume III is a user's manual. It is primarily concerned with the mechanics of operating the program. The user is assumed to be familiar with the contents of Volumes I and II. Many inputs are required and a large portion of these pages are devoted to a description of the inputs. Before discussing the inputs, the configurations the program can model and what constitutes easy and difficult program modifications are reviewed. The output plots and tabulations are also described. Due to the extensive computing time required for a run, a portion of this book is devoted to describing the run time requirements and time saving procedures. In the final section, the interfacing of the program with the user's machine is reviewed.

1.2 Depth of Presentation

Volume III assumes the user has a limited knowledge of the program and wishes to operate same. It is assumed that he is primarily an engineer and secondarily a programmer. How to modify the program is not a subject. The intention is to let the user input-output the program without a complete knowledge of the program code. This statement does not preclude the prospect that minor program changes will be desirable for a new configuration.

2. CONFIGURATIONS MODELED BY REXOR II

2.1 Major Configuration

The program, as presently structured, is limited to helicopter designs featuring a single main rotor and a tail rotor. However, there is nothing in the basic mathematical approach which limits the program to one lifting rotor.

2.2 Overall Configurations

Although the program is limited to one main rotor, the fuselage configuration is readily variable under one assumption; namely, the user is satisfied that the fuselage and its attachments can be treated as one rigid body with flexible rotor mass controls and with rotors which are geared directly to the main rotor. Using inputs alone, a pure helicopter or a compound configuration with a thrustor can be simulated. The size of the horizontal and vertical tail surfaces can be readily changed. The user will find that programming changes for the aerodynamic and inertial characteristics of items attached to the fuselage are relatively easy under the assumption given above.

2.3 Main Rotor Configurations

The program can handle a hingeless or articulated rotor of up to 7 blades. The hingeless design can be either stiff or soft inplane, but no soft inplane design has been operated in the program at this writing. The program has been run however as a soft inplane articulated rotor. The only difference between a hingeless design with a virtual hinge and a blade with a real hinge is in the shape of the blade bending mode in the blade root area and in the spring matrix describing the elastic characteristics of the blade structure itself.

2.4 Control System Configuration

The program models a swashplate driven directly from the cyclic stick through actuators. The swashplate inertia may be so low and the spring rates so high, that it may be appropriate to run the program with the swashplate degrees of freedom locked out. The characteristic frequencies of these modes can be quite high and may lead to computation or numerical instability for a reasonable azimuth step between time points.

3. PROGRAM INPUT

3.1 Relative Address/Master Data Input System

3.1.1 Overview of concept. - REXOR II provides for a comprehensive description of a rotorcraft. Consequently, there are a large number of inputs. To provide a high degree of flexibility in manipulating the input data, a relative address (RA) input system is used. Some attributes of this form of data management are:

- the order of the data is immaterial
- the same item may be in the deck several times, the last one encountered being used.
- only that data which is necessary need be input.

A relative address system coupled with a master/temporary data set philosophy, produces an efficient data handling method.

The master data set procedure provides a mechanism for good data management practices. For example, the master data sets could be stored on a storage device such as tape or disk and retrieved by name. The section which follows will present details concerning the construction and content of the data deck.

3.1.2 Data deck construction. - Data deck construction concepts begin with a series of definitions. The total collection of data submitted to the computer at any one time is called a run deck. A run deck is composed of data cards and control cards. These two card types will be discussed presently. The collection of data cards is called a data unit. Three types of data units will be considered as the basic units of data deck construction. These are:

- master data
- permanent change data
- case data.

Master data is a data unit which will be the base for a series of cases. A data unit which will permanently change the master data unit currently in use is called a permanent change data unit. Values of data defined in this data unit will override corresponding RA's in the master data unit. It should be added that permanency is only as long lived as the data deck in its current configuration. Case data is defined as a data unit which will temporarily override corresponding master data RA's. The resulting data will be executed as a case. The generalized data unit concept leaves the user a great deal of freedom in data collection and management.

The data units within a data deck are identified to the program by control cards. Control card and data card format and definitions follow.

● Control Card Format

All control cards begin in column 1 and are alphanumeric. The 7 control cards are

Column	Column	Column
1	5	9
M A S T E R	:	D A T A
C H A N G E	:	D A T A
C A S E	:	a a a a a a a a
E N D	:	8 Character Case I.D.
E N D A L L	:	
A E R O	1	:
A E R O	2	:

 Program Recognizer Key

Only the first 4 characters are actually used by the program as recognition keys.

● Control Character Definitions

MASTER DATA	This card signals the beginning of a master data deck, i.e.; all data cards which follow, up to the next "END" control card, constitute a master data deck.
CHANGE DATA	This card signals the beginning of a permanent change data deck, i.e.; all data cards which follow, up to the next "END" card, constitute a permanent change data deck.
CASE	This card signals the beginning of a case data unit. This card also contains an 8-character case I.D. in columns 9-16.
END	This card signals the end of a data unit.
ENDALL	This card is the last card of a run deck. It is <u>always required</u> .
AERO 1 AERO 2	These cards signal the beginning of special data units which are handled outside the relative address system. They are discussed in Section 3.2.

Data cards are of two types, numeric and character (alphanumeric). All numeric input data are identified to the program via an address in the range 1 to 3000. Alphanumeric character strings of two general types can also be input to the program via the relative address system. These are case identification titles (see Section 3.4.1) and program output signal titles (see Section 3.4.5.1). Card formats for these data types follow.

● Numeric Data Card Format

One to five inputs can be entered on an input card. The card format is as follows:

<u>Card Column</u>	<u>Field Definition</u>	<u>Quantity</u>	
1 - 4	I4	IR1	right adjusted
5 - 8	I4	IR2	right adjusted
11 - 22	E12.0	V ₁	
23 - 34	E12.0	V ₂	
35 - 46	E12.0	V ₃	
47 - 58	E12.0	V ₄	
59 - 70	E12.0	V ₅	

where IR1 is the RA of the first item on the card

IR2 is the RA of the last item on the card

If one and only one item is input, V₁, then only IR1 is required.

WARNING: THE INPUTS ON A GIVEN CARD ARE SEQUENTIAL, i.e., SKIPPING FIELDS, BY LEAVING BLANK, IS NOT ACCEPTABLE. BLANK FIELDS ARE INTERPRETED AS A ZERO VALUE.

Note the data field specification, E12.0. All inputs are real numbers and can be input in a variety of ways as described in your FORTRAN manual. But remember, an absent decimal point has an assumed position at the right of the field.

For tables of length greater than 5, i.e., more than will go on one data card, the total range may be described by one set of addresses. Let

IR1 be the address of the first entry, and

IR2 be the address of the last entry of the table.

Then skip the IR fields on subsequent cards.

- Alphanumeric Data Card Format

Character strings are addressable by a single address. The card format is as follows.

<u>Card Column</u>	<u>Field Definition</u>	<u>Quantity</u>
1-4	IR	IR
11-70	15A4	CHAR

where IR is the address of character string CHAR up to 60 characters

5000 series addresses are reserved for 20 character output titles.

6000 series addresses are reserved for 60 character title strings.

A run deck is composed of any number of data units with the following restrictions.

- The first data unit must be a master data deck.
- At least one case must be defined.

A case data unit may consist of no changes. However, the presence of a case must be indicated by a "CASE" control card and an END card. The minimum run deck would look like that shown in Figure 1.

A typical data deck structure is given on Figure 2. Note that:

- A master data deck may be updated with any number of permanent change decks
- Change decks and case decks can be interspersed
- Any number of master decks may be present in a run deck. However, a master deck must be followed by at least one case deck.

Finally, an example of a data deck is presented in Figure 3.

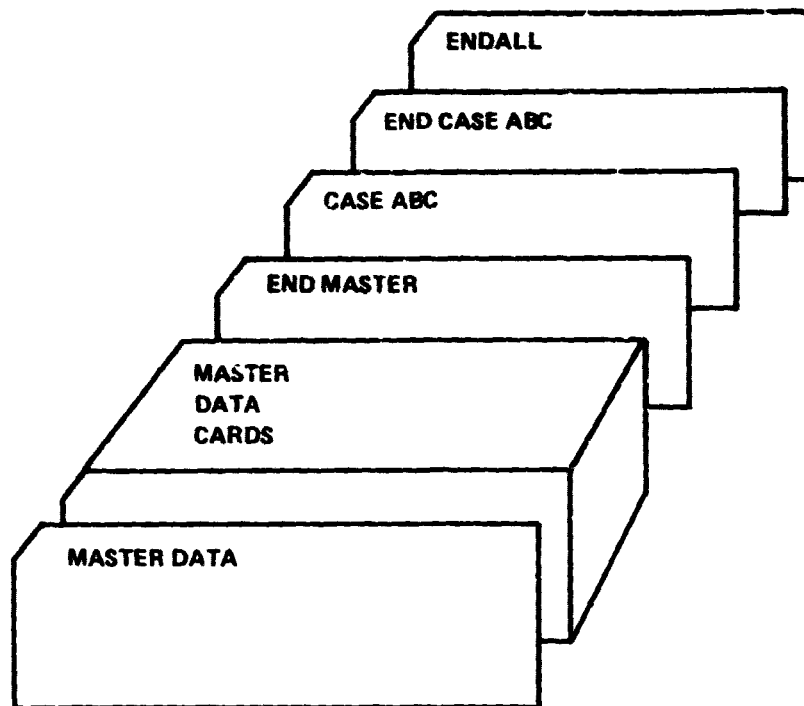


Figure 1. - Minimum configuration.

3.1.3 Operational advantages. - The operation of the RA system permits categorizing data as either master data, master override data, or temporary case data. The system gives each input a unique address number. The advantage of master override is that a large block of data can be changed in the master due to a change of blade, the use of trim save cards, etc., for all the cases to follow. This block of data is easily identified and removed at the end of a series of cases. Hence the integrity of the master data is readily maintained.

The RA system also permits using the F format readin for data, flags, su cion integers, etc. The internal equivalence within REXOR II converts the numbers to the type actually needed. The inputs may even simultaneously be a flag and a physical constant.

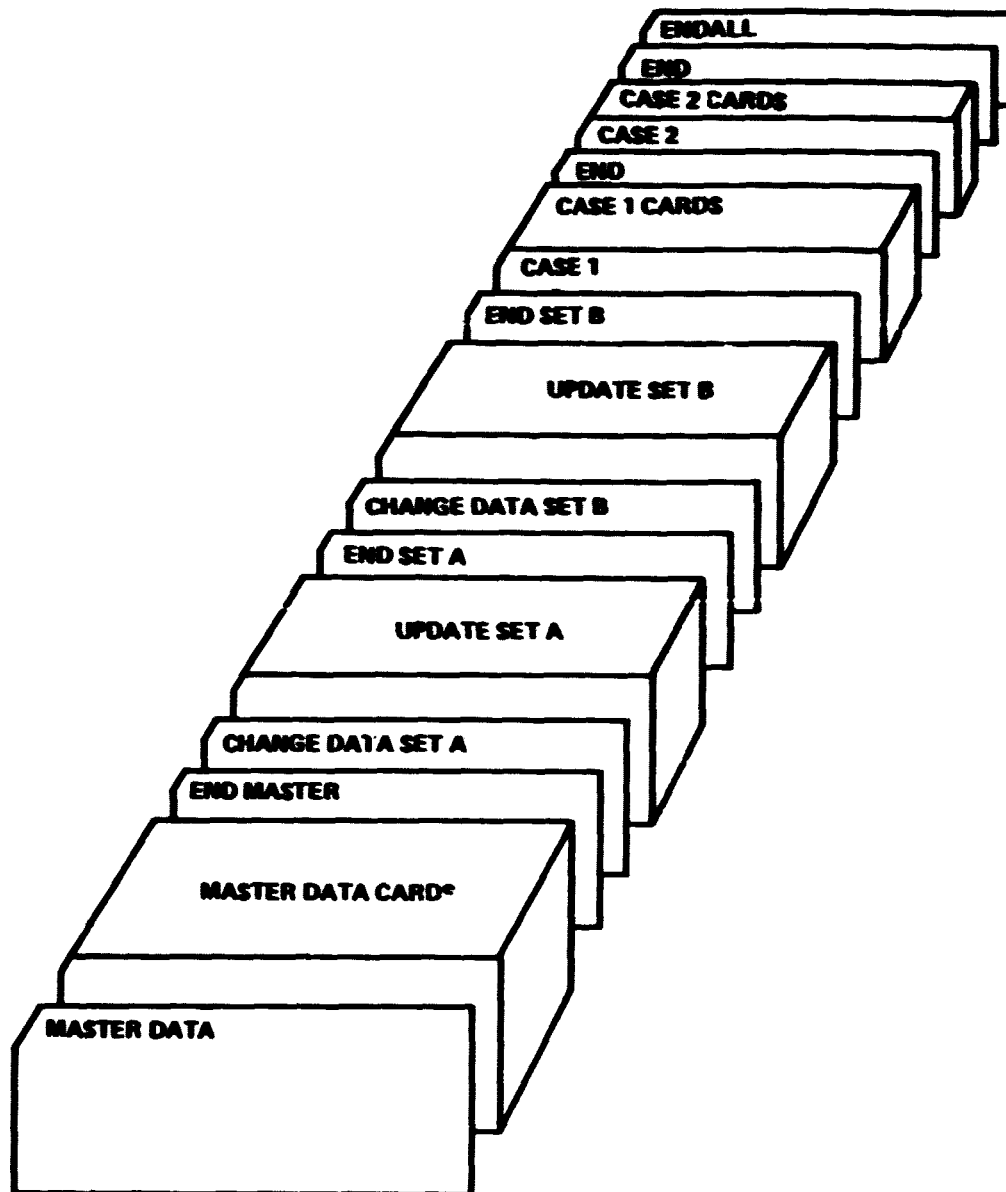


Figure 2. - Typical configuratio:

CARD COLUMNS

	1		2		3		4		5		6		7
12345678901234567890123456789012345678901234567890123456789012													

MASTER DATA

```

6001      SIKORSKY S-58 ON REXOR II
 36      24.
 45 49    1.          1.          0.          1.          1.0
 51      240.
 62      123.
 81      28.
 91      340.
 93      1000.
17911795  1.00000E 02 1.08000E 00 1.10000E 02 1.04000E 00 1.20000E 02
17961800  9.60000E-01 1.80000E 02 0.0          0.0          0.0
 271      1.0
 43      5.0
 53 54    -.1708      -.3276
 99 100    .0098      .12
 370      25722.
 367      .04

```

END OF MASTER DATA

CHANGE DATA DECK THIS IS A BLADE DATA SET

```

498      0.1300E 02
 52      0.2321E 02
1269      0.1500E 02
 501 505  0.1450E 01 0.2750E 01 0.5500E 01 0.7500E 01 0.9500E 01
 506 510  0.1200E 02 0.1375E 02 0.1575E 02 0.1875E 02 0.2150E 02
 511 513  0.2400E 02 0.2575E 02 0.2800E 02
 541 545  0.1744E 01 0.2928E 00 0.1009E 00 0.1622E 00 0.1644E 00
 546 550  0.1596E 00 0.1689E 00 0.1784E 00 0.1540E 00 0.1578E 00
 551 553  0.1856E 00 0.1537E 00 0.2670E 00
12461249  0.1271E 01 0.5823E 00 0.1271E 01 0.3261E 03

```

END OF BLADE DATA SET

CASE 105

```

 56      .2356
1498      0.0
 36      0.0
 48      0.

```

END OF CASE DATA

ENDALL

Figure 3. Data deck card image example.

3.2 Blade Aerodynamic Coefficient Input

Main rotor blade aerodynamic coefficients,

$$C_l = C_l(\alpha, M)$$

$$C_d = C_d(\alpha, M)$$

$$C_m = C_m(\alpha, M),$$

for a NACA 0012 airfoil are compiled within the program, and stored in a region which will be known as SET 2. The user may choose to provide his own airfoil or a set of two airfoils via input. The technique for entering these tables is described in this section. The proper activation and use of the tables provided is discussed in Section 3.4.6.3.

The aerodynamic data block input is handled outside the relative address system of REXOR II. Aero data may be made available to REXOR II for a computer run by placing the proper data blocks ahead of a normal REXOR II data deck. The ability to change section data from case to case is not provided.

Data table formats have been made compatible with Bell's C81 program, as described in Section 2.3 of Volume II of Report USAAMRDL-TR-74-10B (Reference 1). REXOR II provides a slight variation in input. A maximum of two sets, Set 1 and Set 2 can be input. Also, Set 1 or Set 2; or Set 1 and Set 2 may be input.

The presence of an aero set is signaled by a data control card AERO 1 for Set 1 or AERO 2 for Set 2. An AERO control card is followed immediately by the necessary C-81 group ID Card 11A. The formats are presented below for completeness.

CARD 11/A Title and Control Card (7A4, A2, 6I2 format)

Col	1-30	Alphanumeric title for the sets of tables
	31-32	NXL, number of Mach number entries in C_L table
	33-34	NZL, number of angle-of-attack entries in C_L table
	35-36	NXD, number of Mach number entries in C_D table
	37-38	NZD, number of angle-of-attack entries in C_D table
	39-40	NXM, number of Mach number entries in C_M table
	41-42	NXM, number of angle-of-attack entries in C_M table

Lift Coefficient Table

CARD 11/B1 Mach number entries for C_L table (7X, 9F7.0 format)

Col	8-14	M_1 , lowest Mach number
	15-21	M_2 , next highest Mach number
	22-28	M_3 , next highest Mach number
	29-35	M_4 , next highest Mach number
	36-42	M_5 , next highest Mach number
	43-49	M_6 , next highest Mach number
	50-56	M_7 , next highest Mach number
	57-63	M_8 , next highest Mach number
	64-70	M_9 , next highest Mach number

CARDS 11/B2 Additional Mach Numbers (include only if $NXL \geq 10$)

Same format as CARD 11/B1; include additional cards as required with the same format to input NXD values of Mach numbers

Card Sets for Angle of Attack/Lift Coefficient Data

NZL card sets follow the Mach number entries. Each set has the following format:

First Card:

Col	1-7	Angle of attack, degrees
	8-14	Coefficient at $M = M_1$
	15-21	Coefficient at $M = M_2$
	22-28	Coefficient at $M = M_3$
	29-35	Coefficient at $M = M_4$
	36-42	Coefficient at $M = M_5$
	43-49	Coefficient at $M = M_6$
	50-56	Coefficient at $M = M_7$
	57-63	Coefficient at $M = M_8$
	64-70	Coefficient at $M = M_9$

Second Card: (include only if $NZL \geq 10$)

Col 1-7 (Not used)

8-14	Coefficient at $M = M_{10}$
15-21	Coefficient at $M = M_{11}$
22-28	Coefficient at $M = M_{12}$
29-35	Coefficient at $M = M_{13}$
36-42	Coefficient at $M = M_{15}$
43-49	Coefficient at $M = M_{15}$
50-56	Coefficient at $M = M_{16}$
57-63	Coefficient at $M = M_{17}$
64-70	Coefficient at $M = M_{18}$

Third Card: (include only if $NZL \geq 19$)

Same format as Second Card; include additional cards as required to input NXL values of C_L .

Drag Coefficient Table

CARDS 11/C1, 11/C2, etc. Mach number entries

Same format as CARDS 11/B1, 11/B2, etc.; NXD entries required

Card Sets for Angle of Attack/Drag Coefficient Data

NZD card sets required; same format as for lift coefficient card sets; NXD values of C_D required for each card set

Pitching Moment Coefficient Table

CARDS 11/D1, 11/D2, etc. 11/D1, 11/D2, etc.

Same format as lift and drag coefficient tables; NXM Mach number entries required; NZM card sets required with NXM values of C_D for each card set.

3.3 The RA Set (Complete Numerical List)

The listing which follows (Table 1) is designed primarily as a memory aid for the experienced user. Only a brief description of each input is given. The user is advised to consult Section 3.4, which categorizes the inputs into logical groups and supplies comprehensive information as to each input's use. Note the units given in Table 1 reflect conventional units data sets available at this writing. SI unit sets can be used interchangeably.

The following table includes:

- The relative address (RA)
- The equivalenced FORTRAN name
- A brief description
- Typical values and associated units if applicable.

For the sake of completeness, addresses which are not currently used are indicated as OPEN. Program variable dimension information is included where applicable. Parenthesis after the FORTRAN name encloses the array dimensions of that name.

A reverse directory, Table 2, is given to aid in finding the RA number when the FORTRAN name is known.

TABLE 1. - INPUT DATA/RELATIVE ADDRESS TABLE

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1 NB	NUMBER OF MAIN ROTOR BLADES	.4000E 01	
2 IM1	BENDING MODE 1 INDICATOR 1 INDICATES PRESENCE	.1000E 01	
3 IM2	BENDING MODE 2 INDICATOR	.1000E 01	
4 IM3	BENDING MODE 3 INDICATOR	.1000E 01	
5 NBP	ELASTIC FEATHERING INDICATOR	.0000E 00	
6 NPT	DYNAMIC TORSION INDICATOR	.0000E 00	
7 NSP	NUMBER OF SAASHPLATE COORD	.0000E 00	
8 NREF	NUMBER OF REFERENCE SYSTEM COORDINATES	.4000E 01	
9 IS1	SHAFT X INDICATOR	.0000E 00	
10 IS2	SHAFT Y INDICATOR	.0000E 00	
11 IS3	SHAFT Z INDICATOR	.0000E 00	
12 IS4	SHAFT PHI INDICATOR	.0000E 00	
13 IS5	SHAFT INT INDICATOR	.0000E 00	
14 IS6	SHAFT PSI INDICATOR	.0000E 00	
15 NN	NUMBER OF ROTOR COORD	.0000E 00	
16 **OPEN** (15)			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31 MATGEN	GENERATE MASS MATRIX VIA ACCEL. PERTURBATIONS	.0000E 00	

Note: Sample values and units reflect government supplied RSRA data sets.

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
32 DEL0	ELEVATION RIGGING OFFSET	.0000E 00	RAD
33 DAIL0	AILERON RIGGING OFFSET	.0000E 00	RAD
34 THEI0	TAIL ROTON COLLECTIVE RIGGING OFFSET	.0000E 00	RAD
35 DHU00	RUDDER RIGGING OFFSET	.0000E 00	RAD
36 TOUT	WAS REVOLUTIONS TO TRIM	.4000E 01	
37 NC	NUMBER OF DRIVING FUNCTIONS TO TRIM	.6000E 01	
38 NET	INITIAL SIDESLIP ANGLE	.0000E 00	DEG
39 PUD-1	INIT. PERCENT DIVERBRAKE EXTENSION ANGLE	.0000E 00	PERCENT
40 PUEL1	INIT. PERCENT FLAP EXTENSION ANGLE	.0000E 00	PERCENT
41 PDIN1	INIT. PERCENT WING INCIDENCE ANGLE	.0000E 00	PERCENT
42 PDIN1	INIT. PERCENT HORIZONTAL TAIL INCIDENCE ANGLE	.0000E 00	PERCENT
43 NSAVE	SIGNAL SET SAVE FREQ.	.0000E 00	
44 NAEV1	HLAVE STA. INDEX AT WHICH TO SWITCH FROM SET 1 TO 2	.0000E 00	
45 [SNP	SPEED HUNT. DIAGNOSTIC PRINT CHARACTER	.1000E 01	
46 MATPRT	MASS MATRIX PRINT FLAG. IF 1, PRINT INIT. MATRIX	.1000E 01	
47 IPUNCH	PUNCH A TRIM RESTANT DATA DECK DIFF. TRIM	.0000E 00	
48 IPLUT	CALCULATED PLUT FLAG 1=YES	.0000E 00	
49 IPHNT	PRINT OUTPUT FLAG 1=YES SEE MAPS 2449,2000	.1000E 01	
50 UNSTOY	UNSTEADY AERO BYPASS 1=YES	.0000E 00	
51 N-2	AZIMUTH INTERVAL COUNT (MIS/REV)	.2400E 03	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
52 UNFGH	INIT. MAIN MOTOR SPEED	.2321E 02	RAD/SEC
53 PACT	INIT. PERCENT LONG. STICK POSITION, ININ	-.1708E 00	PERCENT
54 PICT	INIT. PERCENT LAT. STICK POSITION, ININ	-.3274E 00	PERCENT
55 PHCT	INIT. PERCENT RUDDER, TRIM	.9137E-01	PERCENT
56 PIHOT	INIT. PERCENT MAIN MOTOR COLLECTIVE, TRIM	.2356E 00	PERCENT
57 PDPT	INIT. PERCENT PROPULSION SETTING, ININ	.0000E 00	PERCENT
58 ALPHA	ANGLE OF ATTACK	-.2904E 01	DEG
59 PHIE	MANR ANGLE	-.8491E 01	DEG
60 **OPEN** (2)			
61			
62 VT	TRAJECTORY VELOCITY	.7288E 02	KNUTS
63 GAMMA	FLIGHT PATH ANGLE	.0000E 00	DEG
64 JETCYC	HLADE JETTISON SEQ. START CYCLE	.0000E 00	
65 WIMR	VERTICAL DOWNWASH	.9448E 01	FT/SEC
66 PIMR	HULL DOWNWASH	-.7483E-02	RAD/SEC
67 DIMR	PITCH DOWNWASH	-.6210E-02	RAD/SEC
68 **OPEN** (3)			
69			
70			
71 WIMRD	D/DOT OF WIMR	.0000E 00	
72 PIMRD	D/DOT PIMR	.0000E 00	
73 DIMRD	D/DOT DIMR	.0000E 00	
74 PXPT	PAC/DTHO	.0000E 00	
75 PYPT	DYC/DTHO	.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
76 PIPT	DTMUTN/DTMD	.0000E 00	
77 AITR	TAIL ROTOR LONG. FLAP ANGLE	.2000E 01	DEG
7A WITR	TAIL ROTOR DOWNWASH	.1560E 02	FT/SEC
79 **OPEN** (2) 80			
81 R	MAIN ROTOR RADIUS	.2800E 02	FT
82 **OPEN** (3) 83 84			
85 TH1	TOTAL BLADE TWIST +DOWN AT TIP	-.0000E 01	DEG
86 GAINC	STICK CONTROL APPORTION FACTOR	.1000E 01	
87 GAINEL	ELEVATOR CONTROL APPORTION FACTOR	.0000E 00	
88 GAINTR	TAIL ROTOR CONTROL APPORTION FACTOR	.1000E 01	
89 GAINAL	AILERON CONTROL APPORTION FACTOR	.0000E 00	
90 GAINRD	RUDDER CONTROL APPORTION FACTOR	.0000E 00	
91 FMASS	FUSELAGE MASS	.3400E 03	SLUG
92 ENDMZZ	ENGINE TRIM TORQUE	.0000E 00	FT-LB
93 H	INITIAL ALTITUDE	.1000E 04	FT
94 EOMT	INIT. DOWNWASH EFF. FACTOR ON HORIZ. TAIL	.0000E 00	
95 EOMTU	INIT. DOWNWASH EFF. FACTOR ON UPPER HORIZ. TAIL	.0000E 00	
96 HF	DISTANCE FROM FUSELAGE AXIS TO HUM +DN	-.0000E 01	FT
97 STR	TAIL ROTOR BLOCKAGE FACTOR	.0500E 00	
98 SLTH	DISTANCE FROM FUSELAGE AXIS TO TAIL ROTOR +AFT	.3300E 02	FT

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
99 CDATH	CON TAIL ROTUM (CD HAN EQ.)	.8800E-02	
100 FATH	R FACTOR (CD HAN EQ.)	.1200E 00	
101 LMT	DISTANCE FROM FUSELAGE AXIS TO HORIZONTAL TAIL AFT	.2800E 02	FT
102 LVT	DISTANCE FROM FUSELAGE AXIS TO VERTICAL TAIL AFT	.3000E 02	FT
103 HVT	DISTANCE FROM FUSELAGE AXIS TO VERTICAL TAIL AUP	.2000E 01	FT
104 EDIT	NEW DATA DECK OPTION: 0=OFF, 1=ON	.0000E 00	
105 TAILON	UPPER HORIZONTAL TAIL FLAG 1=ON	.1000E 01	
106 ETAE	EQUIVALENT VELOCITY RATIO AT TAIL	.9000E 00	
107 PSTMH	PARTIAL OF SIDENASH ANGLE WRT SIDESLIP	.0000E 00	
108 LAMTH	TAIL ROTUM SHAFT HULL ANGLE WRT FUSELAGE AXIS	.0000E 00	DEG
109 RHO	AIR DENSITY	.2050E-02	SLUG/FT3
110 COND	MAIN ROTUM BLADE COND	.1367E 01	FT
111 LMTU	DISTANCE TO UPPER HORIZ. TAIL AFT OF FUSEL. AXIS	.0000E 00	FT
112 **OPEN** (2)			
113			
114 FCF	FEATHER FRICTION	.0000E 00	FT-LB
115 RLF	FEATHER STICTION BREAK POINT	.0000E 00	RAD/SEC
116 FCG	SWASHPLATE FRICTION	.0000E 00	LM
117 RLG	SWASHPLATE STICTION BREAK POINT	.0000E 00	RAD/SEC
118 IZZSP	SWASHPLATE POLAR MOMENT OF INERTIA	.0000E 00	SLUG-FT2

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
119 CHI	CONTROL TO SWP PHASE ANGLE (+) S&P LEADS CONTROL	-.3335E 02	DEG
120 NVT	VERT. TAIL WAKE DEFICIENCY FACTOR	.9000E 00	
121 NMT	HORIZ. TAIL WAKE DEFICIENCY FACTOR	.9000E 00	
122 NHTU	UPPER HORIZ. TAIL WAKE DEFICIENCY FACTOR	.0000E 00	
123 UNYCS	SPRING CONSTANT LONG. STICK OR GEAR RATIO	.3590E 00	FT-LH/FT
124 UNYCS	SPRING CONSTANT LAT. STICK OR GEAR RATIO	.2390E 00	FT-LR/FT
125 METAG	PITCH HORN LEAD AZIMUTH (+) P.M. END OF BLADE	.3335E 02	DEG
126 TORR	DYNAMIC TORSION SPRING	.0000E 00	
127 TORC	DYNAMIC TORSION DAMPER	.0000E 00	
128 FRLUC	INBOARD BEARING LOCATION	.1542E 01	FT
129 DRFAP	DISTANCE BETWEEN FEATHER BEARINGS	.5417E 00	FT
130 **OPEN** (4)			
131			
132			
133			
134 CYCFLG	PLUT SCALE CONTROL 0=SEC/IN , 1=CYCLES/IN	.1000E 01	
135 DEFDA	DE/D(ALPHA) AT TAIL FROM NING	.0000E 00	
136 E	PITCH HORN LENGTH	.1000E 01	FT
137 URGZ1	S&P VERTICAL SPRING RATE	.0000E 00	LB/FT
138 URGZ	S&P VERTICAL DAMPING COEFF	.0000E 00	LH/FT/S
139 SPHASS	S&P MASS	.0000E 00	SLUG
140 URGZ2	S&P VERTICAL LIMITER SPRING RATE	.0000E 00	LH/FT

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
141 ZGI	SAP VERTICAL SPRING BREAKPOINT	.0000E 00	FT
142 ***OPEN**			
143 TURNLF	TURN LOAD FACTOR (TRIM)	.1000E 01	G
144 TURNRN	FLAG FOR TURN LEFT OR RIGHT + RIGHT	-.1000E 01	
145 TPV(1)	PARTIAL FEATHER ANGLE WRT HEND, MODE 1	.0000E 00	
146 TPV(2)	PARTIAL FEATHER ANGLE WRT HEND, MODE 2	.0000E 00	
147 TPV(3)	PARTIAL FEATHER ANGLE WRT HEND, MODE 3	.0000E 00	
148 ***OPEN** (2)			
149			
150 NMP	NO. OF POINTS IN PILOT CONTROL TABLES	.6000E 01	
151 PT (20)	PILOT TIME TABLE	.0000E 00	SEC
152		.5000E 00	SEC
153		.5100E 00	SEC
154		.1400E 01	SEC
155		.1010E 01	SEC
156		.2000E 01	SEC
157		.0000E 00	SEC
158		.0000E 00	SEC
159		.0000E 00	SEC
160		.0000E 00	SEC
161		.0000E 00	SEC
162		.0000E 00	SEC
163		.0000E 00	SEC
164		.0000E 00	SEC
165		.0000E 00	SEC
166		.0000E 00	SEC
167		.0000E 00	SEC
168		.0000E 00	SEC
169		.0000E 00	SEC
170		.0000E 00	SEC
171 XCTH (20)	PILOT LONG. STICK DISPLACEMENT (+) AFT	.0000E 00	PERCENT
172		.0000E 00	PERCENT
173		.1670E 00	PERCENT
174		.1670E 00	PERCENT

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
175		.0000E 00	PERCENT
176		.0000E 00	PERCENT
177		.0000E 00	PERCENT
178		.0000E 00	PERCENT
179		.0000E 00	PERCENT
180		.0000E 00	PERCENT
181		.0000E 00	PERCENT
182		.0000E 00	PERCENT
183		.0000E 00	PERCENT
184		.0000E 00	PERCENT
185		.0000E 00	PERCENT
186		.0000E 00	PERCENT
187		.0000E 00	PERCENT
188		.0000E 00	PERCENT
189		.0000E 00	PERCENT
190		.0000E 00	PERCENT
191 YCTB (20)	PILOT LAT. STICK DISPLACEMENT (+) WT	.0000E 00	PERCENT
192		.0000E 00	PERCENT
193		.0000E 00	PERCENT
194		.0000E 00	PERCENT
195		.0000E 00	PERCENT
196		.0000E 00	PERCENT
197		.0000E 00	PERCENT
198		.0000E 00	PERCENT
199		.0000E 00	PERCENT
200		.0000E 00	PERCENT
201		.0000E 00	PERCENT
202		.0000E 00	PERCENT
203		.0000E 00	PERCENT
204		.0000E 00	PERCENT
205		.0000E 00	PERCENT
206		.0000E 00	PERCENT
207		.0000E 00	PERCENT
208		.0000E 00	PERCENT
209		.0000E 00	PERCENT
210		.0000E 00	PERCENT
211 THTAH (20)	PILOT COLLECTIVE INPUT (+) THRUST	.0000E 00	PERCENT
212		.0000E 00	PERCENT
213		.0000E 00	PERCENT
214		.0000E 00	PERCENT
215		.0000E 00	PERCENT
216		.0000E 00	PERCENT
217		.0000E 00	PERCENT
218		.0000E 00	PERCENT
219		.0000E 00	PERCENT
220		.0000E 00	PERCENT

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
221		.0000E 00	PERCENT
222		.0000E 00	PERCENT
223		.0000E 00	PERCENT
224		.0000E 00	PERCENT
225		.0000E 00	PERCENT
226		.0000E 00	PERCENT
227		.0000E 00	PERCENT
228		.0000E 00	PERCENT
229		.0000E 00	PERCENT
230		.0000E 00	PERCENT
231	MC28 (20) PILOT RUDDER PEDAL INPUT	.0000E 00	PERCENT
232		.0000E 00	PERCENT
233		.0000E 00	PERCENT
234		.0000E 00	PERCENT
235		.0000E 00	PERCENT
236		.0000E 00	PERCENT
237		.0000E 00	PERCENT
238		.0000E 00	PERCENT
239		.0000E 00	PERCENT
240		.0000E 00	PERCENT
241		.0000E 00	PERCENT
242		.0000E 00	PERCENT
243		.0000E 00	PERCENT
244		.0000E 00	PERCENT
245		.0000E 00	PERCENT
246		.0000E 00	PERCENT
247		.0000E 00	PERCENT
248		.0000E 00	PERCENT
249		.0000E 00	PERCENT
250		.0000E 00	PERCENT
251	OPT8 (20) PILOT PROPULSION SETTING	.0000E 00	PERCENT
252		.0000E 00	PERCENT
253		.0000E 00	PERCENT
254		.0000E 00	PERCENT
255		.0000E 00	PERCENT
256		.0000E 00	PERCENT
257		.0000E 00	PERCENT
258		.0000E 00	PERCENT
259		.0000E 00	PERCENT
260		.0000E 00	PERCENT
261		.0000E 00	PERCENT
262		.0000E 00	PERCENT
263		.0000E 00	PERCENT
264		.0000E 00	PERCENT
265		.0000E 00	PERCENT
266		.0000E 00	PERCENT
267		.0000E 00	PERCENT
268		.0000E 00	PERCENT

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
269		.0000E 00	PERCENT
270		.0000E 00	PERCENT
271 DUE0	SIP TO FEATHER GEAR RATIO AT ZERO COLLECTIVE	.1000E 01	
272 DUE1	VARIATION ON D/E WITH COLL.	.0700E 00	1/RAD
273 AONPEH00			
274 YTR	TAIL ROTOR LATERAL OFFSET	-.2400E 01	FT
275 FHLN11,1	FEATHER BEARING MODE 1 INBOARD Y DISPL +FWD	.1981E-01	
276 FHLN12,1	INBOARD Z DISPL +DN	-.3742E-04	
277 FHLN11,2	OUTBOARD Y DISPL +FWD	.3962E-01	
278 FHLN12,2	OUTBOARD Z DISPL +DN	-.7440E-04	
279 FHLN21,1	FEATHER BEARING MODE 2 INBOARD Y	-.4177E-04	
280 FHLN22,1	INBOARD Z	.1961E-01	
281 FHLN21,2	OUTBOARD Y	-.4550E-04	
282 FHLN22,2	OUTBOARD Z	.3923E-01	
283 FHLN31,1	FEATHER BEARING MODE 3 INBOARD Y	-.1044E-01	
284 FHLN32,1	INBOARD Z	-.3948E-01	
285 FHLN31,2	OUTBOARD Y	-.2007E-01	
286 FHLN32,2	OUTBOARD Z	-.7975E-01	
287 TC(1)	TAIL ROTOR DOWNWASH TIME CONST (TRIM)	.1000E 01	SEC
288 TC(2)	TAIL ROTOR DOWNWASH TIME CONST (FLY)	.5000E-01	SEC
289 TC(3)	TAIL ROTOR FLAP TIME CONST	.1000E 00	SEC
290 TC(4)		.0000E 00	
291 TC(5)		.0000E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
202 TAIIC	PILOT LONGITUDINAL ACTUATOR TIME CONSTANT	.2500E-01	SEC
203 TAIYC	PILOT LATERAL ACTUATOR TIME CONSTANT	.2500E-01	SEC
204 TAS	FEATHER SPRING	.0000E 00	FT-LB/RD
205 ***OPEN** (2) 206			
207 DSTAF	HL STA. FINN EFFECTIVE SWEEP AND PHINIP OUTPUT	.0000E 00	FT
208 TSCLE	PLAT SCALE FACTOR (ABSCISSA) UNITS PER INCH OF PLOT	.1000E 01	
209 ***OPEN**			
300 NYAN	NO. OF SIGNALS TO BE PLOTTED	.6400E 02	
301 USPI 1	SWASHPLATE COORD INITIAL CONDITIONS (DISPL)	.9420E-01	
302 USPI 2		.3170E-01	
303 USPI 3		.0000E 00	
304 USPI 1	SWASHPLATE COORD INITIAL CONDITIONS (VEL)	.0000E 00	
305 USPI 2		.0000E 00	
306 USPI 3		.0000E 00	
307 USPI 1	SWASHPLATE COORD INITIAL CONDITIONS (ACCEL)	.0000E 00	
308 USPI 2		.0000E 00	
309 USPI 3		.0000E 00	
310 USI 1	SHAFT DISPL INIT. CONDITIONS	.0000E 00	
311 USI 2		.0000E 00	
312 USI 3		.0000E 00	
313 USI 4		.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
314 OSI 5		.0000E 00	
315 OSI 6		.0000E 00	
316 OSI 1	SHAFT VEL INIT. CONDITIONS	.0000E 00	
317 OSI 2		.0000E 00	
318 OSI 3		.0000E 00	
319 OSI 4		.0000E 00	
320 OSI 5		.0000E 00	
321 OSI 6		.0000E 00	
322 OSI 1	SHAFT ACCEL INIT. CONDITIONS	.0000E 00	
323 OSI 2		.0000E 00	
324 OSI 3		.0000E 00	
325 OSI 4		.0000E 00	
326 OSI 5		.0000E 00	
327 OSI 6		.0000E 00	
328 P REF 1	INIT. ROLL RATE (REF SYS)	.0000E 00	RAD/SEC
329 H REF 1	INIT. PITCH RATE (REF SYS)	.0000E 00	RAD/SEC
330 W REF 1	INIT. YAW RATE (REF SYS)	.0000E 00	RAD/SEC
331 XDDOPE I	INIT. XDD (REF SYS)	-.2079E 01	FT/SEC2
332 YDDOPE I	INIT. YDD (REF SYS)	.2394E 01	FT/SEC2
333 ZDDOPE I	INIT. ZDD +DN (REF SYS)	-.3181E 02	FT/SEC2
334 PD REF 1	INIT. PHID (REF SYS)	.0000E 00	RAD/SEC2
335 HD REF 1	INIT. HHD (REF SYS)	.0000E 00	RAD/SEC2
336 WD REF 1	INIT. WHD (REF SYS)	.0000E 00	RAD/SEC2
337 XDDPE:++(24)			
338			
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340			

TABLE 1. - Continued

N/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
341			
342			
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360			
361 IXISP	SHD ROLL INERTIA	.0000E 00	SLUG-FT2
362 COMPEN00(4)			
363			
364			
365			
366 MASS		.1000E 02	
367 VP(1)	PARTIAL Y WNT MODE 1 AT LAG DAMPER LUC.	.4000E-01	
368 VP(2)	PARTIAL Y WNT MODE 2 AT LAG DAMPER LUC.	.0000E 00	
369 VP(3)	PARTIAL Y WNT MODE 3 AT LAG DAMPER LUC.	.0000E 00	
370 CLAG1	INPLANE LAG DAMPER CONST., LOW VELOCITY	.0000E 00	
371 CLAG2	INPLANE LAG DAMPER CONST., HIGH VELOCITY	.2572E 05	
372 XFRAN	XCG IN FUSELAGE COORD +FWD	.6000E 00	FT
373 YFRAN	YCG IN FUSELAGE COORD +HT	.0000E 00	FT
374 ZFRAN	ZCG IN FUSELAGE COORD +DN	.0000E 00	FT

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
375 *00PE400			
376 KPMCON	SWASHPLATE SPRING (ROLL) IN CONTROL AXIS	.1000E 01	FT-LB/RD
377 KPMCON	SWASHPLATE SPRING (PITCH) IN CONTROL AXIS	.1000E 01	FT-LB/RD
378 CPMOSP	SWASHPLATE DAMPER (ROLL) IN CONTROL AXIS	.0000E 00	F-LB/R/S
379 CTMOSP	SWASHPLATE DAMPER (PITCH) IN CONTROL AXIS	.0000E 00	F-LB/R/S
380 ATTP	TIP LOSS FACTOR	.9700E 00	
381 PEMFL	PART. OF DOWNWASH EFF. HORIZ TAIL ANT FLAP ANGLE	.0000E 00	
382 PEMIN	PART. OF DOWNWASH EFF. HORIZ TAIL ANT WING INCID.	.0000E 00	
383 PEMH	PART. OF DOWNWASH EFF. HORIZ TAIL ANT ALPHA	.0000E 00	
384 PENTFL	PART. OF DOWNWASH EFF. UPPER HORIZ TAIL ANT FLAP ANG.	.0000E 00	
385 PENTIN	PART. OF DOWNWASH EFF. UPPER HORIZ TAIL ANT WING INC.	.0000E 00	
386 PSVTH	PART. VENT. TAIL SOLIDITY ANT WING	.0000E 00	
387 TANNIN	PURGE VEL. EFF. FACTOR	.0000E 00	
388 TAVEL	ELEVATION VEL. EFF. FACTOR	.0000E 00	
389 TAVMT	HORIZ. TAIL VEL. EFF. FACTOR	.0000E 00	
390 PCDFL	DRAG COEFF WISE VS. FLAP EXTENSION	.0000E 00	
391 PCLFL	LIFT COEFF VS. FLAP EXTENSION	.0000E 00	
392 PCMFL	PITCHING MOM. COEFF VS. FLAP EXTENSION	.0000E 00	
393 PCOAN	DRAG COEFF CHANGE WRT ANGLE OF ATTACK OF WING	.0000E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
390 PELAN	LIFT CURFF CHANGE WRT ANGLE OF ATTACK OF WING	.0000E 00	
395 PCMAN	PITCHING MOM. COEFF VS. ANGLE OF ATTACK OF WING	.0000E 00	
396 PVAL	AILERON CONTROL MOM. VOL. VS. AILERON DEFLECTION	.0000E 00	
397 PSNG	DNAG CURFF RISE VS. DIVE MAKE EXTENSION	.0000E 00	
398 NOM	LHC. OF DIVE MAKE CENTER OF PRESSURE ABOVE FUSELAGE AXES	.0000E 00	
399 **OPEN** (2)			
400			
401 SHAFK (36)	SHAFT STIFFNESS MATRIX (6,6) ARRAY	.0000E 00	
402		.0000E 00	
403		.0000E 00	
404		.0000E 00	
405		.0000E 00	
406		.0000E 00	
407		.0000E 00	
408		.0000E 00	
409		.0000E 00	
410		.0000E 00	
411		.0000E 00	
412		.0000E 00	
413		.0000E 00	
414		.0000E 00	
415		.0000E 00	
416		.0000E 00	
417		.0000E 00	
418		.0000E 00	
419		.0000E 00	
420		.0000E 00	
421		.0000E 00	
422		.0000E 00	
423		.0000E 00	
424		.0000E 00	
425		.0000E 00	
426		.0000E 00	
427		.0000E 00	
428		.0000E 00	
429		.0000E 00	
430		.0000E 00	
431		.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
432		.0000E 00	
433		.0000E 00	
434		.0000E 00	
435		.0000E 00	
436		.0000E 00	
437 NATLXC	MAX. LONG. STICK ACTUATION RATE LIMIT	.1000E 04	FT/SEC
438 NATLYC	MAX. LAT. STICK ACTUATION RATE LIMIT	.1000E 04	FT/SEC
439 YNPI	LAC DAMPER BREAK POINT	.0000E 00	RAD/SEC
440 ***OPEN**			
441 FNN (42)	NOUW AIRLOAD COEFF MATRIX (0,7) ARRAY	.0000E 00	
442		.0000E 00	
443		.0000E 00	
444		.0000E 00	
445		.0000E 00	
446		.0000E 40	
447		.0000E 00	
448		.0000E 00	
449		.0000E 00	
450		.0000E 00	
451		.0000E 00	
452		.0000E 00	
453		.0000E 00	
454		-.2000E 00	
455		.0000E 00	
456		.0000E 00	
457		.0000E 00	
458		.0000E 00	
459		.0000E 00	
460		.0000E 00	
461		.0000E 00	
462		.0000E 00	
463		.0000E 00	
464		.0000E 00	
465		.0000E 00	
466		.0000E 00	
467		-.3000E-01	
468		.0000E 00	
469		-.1000E 01	
470		.0000E 00	
471		.0000E 00	
472		-.5000E-01	
473		.0000E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
474		.0000E 00	
475		.0000E 00	
476		.1670E 01	
477		.0000E 00	
478		.0000E 00	
479		.0000E 00	
480		.0000E 00	
481		.0000E 00	
482		.0000E 00	
483	000PEN00(0)		
484			
485			
486			
487			
488			
489			
491 DZFHH(1)	X-DISPLACEMENT, FUSELAGE TO TRANS. MOUNT BASE	.0000E 00	FT
492 DZFHH(2)	Y-DISPLACEMENT, FUSELAGE TO TRANS. MOUNT BASE	.0000E 00	FT
493 DZFHH(3)	Z-DISPLACEMENT, FUSELAGE TO TRANS. MOUNT BASE	-.5500E 01	FT
494 000PEN00			
495 DZMHH(1)	X-DISPLACEMENT, TRANS. MOUNT TO MHH	.0000E 00	FT
496 DZMHH(2)	Y-DISPLACEMENT, TRANS. MOUNT TO MHH	.0000E 00	FT
497 DZMHH(3)	Z-DISPLACEMENT, TRANS. MOUNT TO MHH	-.2500E 01	FT
498 NHAD	Nº. OF BLADE STATIONS	.1300E 02	
499 000PEN00(2)			
500			
501 3X (20)	BLADE STATIONS	.1450E 01	FT
502		.2750E 01	FT
503		.5500E 01	FT
504		.7500E 01	FT
505		.4500E 01	FT
506		.1200E 02	FT

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
507		.1375E 02	FT
508		.1575E 02	FT
509		.1875E 02	FT
510		.2150E 02	FT
511		.2400E 02	FT
512		.2575E 02	FT
513		.2800E 02	FT
514		.0000E 00	FT
515		.0000E 00	FT
516		.0000E 00	FT
517		.0000E 00	FT
518		.0000E 00	FT
519		.0000E 00	FT
520		.0000E 00	FT
521 31	(21) BLADE ELEMENT C.G. LOC REL. TO QUANTUM CUMD	.0000E 00	FT
522		.0000E 00	FT
523		.0000E 00	FT
524		.0000E 00	FT
525		.0000E 00	FT
526		.0000E 00	FT
527		.0000E 00	FT
528		.0000E 00	FT
529		.0000E 00	FT
530		.0000E 00	FT
531		.0000E 00	FT
532		.0000E 00	FT
533		.0000E 00	FT
534		.0000E 00	FT
535		.0000E 00	FT
536		.0000E 00	FT
537		.0000E 00	FT
538		.0000E 00	FT
539		.0000E 00	FT
540		.0000E 00	FT
541 04	(20) BLADE DISTRIBUTED MASS AT EACH STATION	.1744E 01	SLUG/FT
542		.2928E 00	SLUG/FT
543		.1009E 00	SLUG/FT
544		.1672E 00	SLUG/FT
545		.1644E 00	SLUG/FT
546		.1596E 00	SLUG/FT
547		.1644E 00	SLUG/FT
548		.1744E 00	SLUG/FT
549		.1540E 00	SLUG/FT
550		.1578E 00	SLUG/FT
551		.1856E 00	SLUG/FT
552		.1537E 00	SLUG/FT

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
553		.2670E 00	SLUG/FT
554		.0000E 00	SLUG/FT
555		.0000E 00	SLUG/FT
556		.0000E 00	SLUG/FT
557		.0000E 00	SLUG/FT
558		.0000E 00	SLUG/FT
559		.0000E 00	SLUG/FT
560		.0000E 00	SLUG/FT
561 MI	(20) BLADE DISTRIBUTED MOMENT OF INERTIA ABOUT CG	.1764E 00	SLUG-FT
562		.1121E-01	SLUG-FT
563		.9777E-02	SLUG-FT
564		.1695E-01	SLUG-FT
565		.1612E-01	SLUG-FT
566		.1644E-01	SLUG-FT
567		.1706E-01	SLUG-FT
568		.1792E-01	SLUG-FT
569		.1518E-01	SLUG-FT
570		.1541E-01	SLUG-FT
571		.1814E-01	SLUG-FT
572		.1527E-01	SLUG-FT
573		.2764E-01	SLUG-FT
574		.0000E 00	SLUG-FT
575		.0000E 00	SLUG-FT
576		.0000E 00	SLUG-FT
577		.0000E 00	SLUG-FT
578		.0000E 00	SLUG-FT
579		.0000E 00	SLUG-FT
580		.0000E 00	SLUG-FT
581 **OPEN**	(10)		
582			
583			
584			
585			
586			
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590			
591 PGENG	TORQUE VS GEN. SPEED RATIO	.0000E 00	F-LB/R/S
592 PUEOM	TORQUE VS MOTOR SPEED RATIO	.0000E 00	F-LB/R/S
593 K1PRM	ACCEL. FEEDBACK GAIN	.0000E 00	
594 K2PRM	SPEED FEEDBACK GAIN	.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
595 TAUC	COMPRESSOR TIME CONSTANT	.0000E 00	SEC
596 **OPEN** (45)			
597			
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641 PSITH (20)	PILOT ENGINE SPEED VARIATION	.0000E 00	RAD/SEC
642		.0000E 00	RAD/SEC

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
643		.0000E 00	RAD/SEC
644		.0000E 00	RAD/SEC
645		.0000E 00	RAD/SEC
646		.0000E 00	RAD/SEC
647		.0000E 00	RAD/SEC
648		.0000E 00	RAD/SEC
649		.0000E 00	RAD/SEC
650		.0000E 00	RAD/SEC
651		.0000E 00	RAD/SEC
652		.0000E 00	RAD/SEC
653		.0000E 00	RAD/SEC
654		.0000E 00	RAD/SEC
655		.0000E 00	RAD/SEC
656		.0000E 00	RAD/SEC
657		.0000E 00	RAD/SEC
658		.0000E 00	RAD/SEC
659		.0000E 00	RAD/SEC
660		.0000E 00	RAD/SEC
661 **OPEN** (10)			
662			
663			
664			
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670			
671 FUNC0 (10)	TRIM CONTROL FUNCTION DESIRED VALUE TABLE	.0000E 00	
672		.0000E 00	
673		.0000E 00	
674		.0000E 00	
675		.0000E 00	
676		.0000E 00	
677		.0000E 00	
678		.0000E 00	
679		.0000E 00	
680		.0000E 00	
681 DBPTH (20)	PILOT DIVE BRAKE SETTINGS	.0000E 00	
682		.0000E 00	
683		.0000E 00	
684		.0000E 00	
685		.0000E 00	
686		.0000E 00	
687		.0000E 00	
688		.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
689		.0000E 00	
690		.0000E 00	
691		.0000E 00	
692		.0000E 00	
693		.0000E 00	
694		.0000E 00	
695		.0000E 00	
696		.0000E 00	
697		.0000E 00	
698		.0000E 00	
699		.0000E 00	
700		.0000E 00	
701 FLPTB (20)	PILOT FLAP EXTENSION SETTINGS	.0000E 00	
702		.0000E 00	
703		.0000E 00	
704		.0000E 00	
705		.0000E 00	
706		.0000E 00	
707		.0000E 00	
708		.0000E 00	
709		.0000E 00	
710		.0000E 00	
711		.0000E 00	
712		.0000E 00	
713		.0000E 00	
714		.0000E 00	
715		.0000E 00	
716		.0000E 00	
717		.0000E 00	
718		.0000E 00	
719		.0000E 00	
720		.0000E 00	
721 WIPTB (20)	PILOT WING INCIDENCE SETTINGS	.0000E 00	
722		.0000E 00	
723		.0000E 00	
724		.0000E 00	
725		.0000E 00	
726		.0000E 00	
727		.0000E 00	
728		.0000E 00	
729		.0000E 00	
730		.0000E 00	
731		.0000E 00	
732		.0000E 00	
733		.0000E 00	
734		.0000E 00	
735		.0000E 00	
736		.0000E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
737		.0000E 00	
738		.0000E 00	
739		.0000E 00	
740		.0000E 00	
741	WTPA (20) PILOT MINIZ. TAIL INCIDENCE SETTINGS	.0000E 00	
742		.0000E 00	
743		.0000E 00	
744		.0000E 00	
745		.0000E 00	
746		.0000E 00	
747		.0000E 00	
748		.0000E 00	
749		.0000E 00	
750		.0000E 00	
751		.0000E 00	
752		.0000E 00	
753		.0000E 00	
754		.0000E 00	
755		.0000E 00	
756		.0000E 00	
757		.0000E 00	
758		.0000E 00	
759		.0000E 00	
760		.0000E 00	
761	WSPH V (20) V DISPL. MODE 1	.0000E 00	
762		.0000E-01	
763		.1640E 00	
764		.2343E 00	
765		.3120E 00	
766		.0044E 00	
767		.4692E 00	
768		.5435E 00	
769		.6550E 00	
770		.7575E 00	
771		.8507E 00	
772		.9160E 00	
773		.1000E 01	
774		.0000E 00	
775		.0000E 00	
776		.0000E 00	
777		.0000E 00	
778		.0000E 00	
779		.0000E 00	
780		.0000E 00	
781	WSPH Z (20) Z DISPL. MODE 1	.0000E 00	
782		-.1210E-03	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
783		-.2000E-03	
784		-.2600E-03	
785		-.2510E-03	
786		-.2110E-03	
787		-.1750E-03	
788		-.1270E-03	
789		-.4303E-04	
790		.4500E-04	
791		.1301E-03	
792		.1900E-03	
793		.2839E-03	
794		.0000E 00	
795		.0000E 00	
796		.0000E 00	
797		.0000E 00	
798		.0000E 00	
799		.0000E 00	
800		.0000E 00	
801	HMSM1 VP(20) NY/OS MODE 1	.0000E 00	
802		.3659E-01	
803		.3671E-01	
804		.3681E-01	
805		.3690E-01	
806		.3701E-01	
807		.3700E-01	
808		.3715E-01	
809		.3723E-01	
810		.3720E-01	
811		.3731E-01	
812		.3731E-01	
813		.3732E-01	
814		.0000E 00	
815		.0000E 00	
816		.0000E 00	
817		.0000E 00	
818		.0000E 00	
819		.0000E 00	
820		.0000E 00	
821	HMSM1 ZP(20) NY/OS MODE 1	.0000E 00	
822		-.7053E-04	
823		-.1939E-04	
824		.2220E-06	
825		.1021E-04	
826		.1757E-04	
827		.2100E-04	
828		.2457E-04	
829		.2927E-04	
830		.3350E-04	

TABLE 1. - Continued

R/ PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
831		.3020E-04	
832		.3721E-04	
833		.3755E-04	
834		.0000E 00	
835		.0000E 00	
836		.0000E 00	
837		.0000E 00	
838		.0000E 00	
839		.0000E 00	
840		.0000E 00	
841	84342 Y (20) Y DISPL. MODE 2	.0000E 00	
842		-.1355E-03	
843		-.2050E-03	
844		-.3100E-03	
845		-.3170E-03	
846		-.2000E-03	
847		-.2500E-03	
848		-.2023E-03	
849		-.4030E-04	
850		.2250E-04	
851		.1512E-03	
852		.2400E-03	
853		.3770E-03	
854		.0000E 00	
855		.0000E 00	
856		.0000E 00	
857		.0000E 00	
858		.0000E 00	
859		.0000E 00	
860		.0000E 00	
861	84342 Z (20) Z DISPL. MODE 2	.0000E 00	
862		.6337E-01	
863		.1434E 00	
864		.2366E 00	
865		.3102E 00	
866		.4025E 00	
867		.4673E 00	
868		.5410E 00	
869		.6534E 00	
870		.7562E 00	
871		.8499E 00	
872		.9156E 00	
873		.1000E 01	
874		.0000E 00	
875		.0000E 00	
876		.0000E 00	
877		.0000E 00	
878		.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
879		.0000E 00	
880		.0000E 00	
881	M43M2 VP(20) 01/05 MODE 2	.0000E 00	
882		-.7437E-04	
883		-.2764E-04	
884		-.6932E-05	
885		.5734E-05	
886		.1465E-04	
887		.2291E-04	
888		.2970E-04	
889		.3966E-04	
890		.4921E-04	
891		.5449E-04	
892		.5632E-04	
893		.5719E-04	
894		.0000E 00	
895		.0000E 00	
896		.0000E 00	
897		.0000E 00	
898		.0000E 00	
899		.0000E 00	
900		.0000E 00	
901	M43M2 ZP(20) 02/05 MODE 2	.0000E 00	
902		.3622E-01	
903		.3653E-01	
904		.3670E-01	
905		.3645E-01	
906		.3700E-01	
907		.3710E-01	
908		.3720E-01	
909		.3733E-01	
910		.3743E-01	
911		.3750E-01	
912		.3752E-01	
913		.3753E-01	
914		.0000E 00	
915		.0000E 00	
916		.0000E 00	
917		.0000E 00	
918		.0000E 00	
919		.0000E 00	
920		.0000E 00	
921	M43M3 Y (20) Y DISPL. MODE 3	.0000E 00	
922		-.5239E-01	
923		-.7096E-01	
924		-.1042E 00	
925		-.1247E 00	

TABLE 1. - Continued

P/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
024		-.1390E 00	
027		-.1370E 00	
028		-.1214E 00	
029		-.7274E-01	
030		-.2607E-02	
031		.7410E-01	
032		.1407E 00	
033		.2241E 00	
034		.0000E 00	
035		.0000E 00	
036		.0000E 00	
037		.0000E 00	
038		.0000E 00	
039		.0000E 00	
040		.0000E 00	
041	MM543 Z (20) Z DISPL. MODE 3	.0000E 00	
042		-.1244E 00	
043		-.5194E 00	
044		-.4364E 00	
045		-.5257E 00	
046		-.5428E 00	
047		-.5400E 00	
048		-.5272E 00	
049		-.3350E 00	
050		-.3744E-01	
051		.3230E 00	
052		.6113E 00	
053		.1000E 01	
054		.0000E 00	
055		.0000E 00	
056		.0000E 00	
057		.0000E 00	
058		.0000E 00	
059		.0000E 00	
060		.0000E 00	
061	MM543 VP(20) VT/DS MODE 3	.0000E 00	
062		-.1442E-01	
063		-.1564E-01	
064		-.1230E-01	
065		-.7751E-02	
066		-.9172E-03	
067		.4504E-02	
068		.1119E-01	
069		.2121E-01	
070		.2439E-01	
071		.3455E-01	
072		.3634E-01	
073		.3707E-01	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
974		.0000E 00	
975		.0000E 00	
976		.0000E 00	
977		.0000E 00	
978		.0000E 00	
979		.0000E 00	
980		.0000E 00	
981	ANSN3 ZP(20) 02/03 MODE 3	.0000E 00	
982		-.7330E-01	
983		-.6376E-01	
984		-.5147E-01	
985		-.3525E-01	
986		-.4040E-02	
987		.1241E-01	
988		.4124E-01	
989		.4713E-01	
990		.1244E 00	
991		.1573E 00	
992		.1644E 00	
993		.1724E 00	
994		.4000E 00	
995		.0000E 00	
996		.0000E 00	
997		.0000E 00	
998		.0000E 00	
999		.0000E 00	
1000		.0000E 00	
1001 UC	(200) OUTPUT SIGNAL UNIT CONVERSION TABLE	.0000E 00	
1002		.0000E 00	
1003		.0000E 00	
1004		.0000E 00	
1005		.5730E 02	
1006		.5730E 02	
1007		.0000E 00	
1008		.1200E 02	
1009		.1200E 02	
1010		.5730E 02	
1011		.5730E 02	
1012		.0000E 00	
1013		.5730E 02	
1014		.5730E 02	
1015		.5730E 02	
1016		.5730E 02	
1017		.5730E 02	
1018		.5730E 02	
1019		.5730E 02	
1020		.0000E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1021		.0000E 00	
1022		.0000E 00	
1023		.0000E 00	
1024		.0000E 00	
1025		.0000E 00	
1026		.0000E 00	
1027		.0000E 00	
1028		.0000E 00	
1029		.0000E 00	
1030		.0000E 00	
1031		.5730E 02	
1032		.0000E 00	
1033		.0000E 00	
1034		.0000E 00	
1035		.0000E 00	
1036		.0000E 00	
1037		.0000E 00	
1038		.0000E 00	
1039		.0000E 00	
1040		.0000E 00	
1041		.0000E 00	
1042		.0000E 00	
1043		.0000E 00	
1044		.0000E 00	
1045		.0000E 00	
1046		.0000E 00	
1047		.0000E 00	
1048		.5730E 02	
1049		.5730E 02	
1050		.5730E 02	
1051		.5730E 02	
1052		.5730E 02	
1053		.0000E 00	
1054		.0000E 00	
1055		.0000E 00	
1056		.0000E 00	
1057		.5730E 02	
1058		.5730E 02	
1059		.5730E 02	
1060		.1200E 02	
1061		.1200E 02	
1062		.1200E 02	
1063		.5730E 02	
1064		.5730E 02	
1065		.5730E 02	
1066		.0000E 00	
1067		.0000E 00	
1068		.5730E 02	
1069		.5730E 02	
1070		.5730E 02	

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TABLE 1. - Continued

R/A PHONGNAN SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1071		.5730E 02	
1072		.0400E 00	
1073		.0000E 00	
1074		.0000E 00	
1075		.0000E 00	
1076		.0000E 00	
1077		.0000E 00	
1078		.0000E 00	
1079		.0000E 00	
1080		.0000E 00	
1081		.5730E 02	
1082		.5730E 02	
1083		.5730E 02	
1084		.0000E 00	
1085		.0000E 00	
1086		.0000E 00	
1087		.0000E 00	
1088		.0000E 00	
1089		.0000E 00	
1090		.0000E 00	
1091		.0000E 00	
1092		.0000E 00	
1093		.0000E 00	
1094		.0000E 00	
1095		.0000E 00	
1096		.0000E 00	
1097		.0000E 00	
1098		.0000E 00	
1099		.0000E 00	
1100		.0000E 00	
1101		.0000E 00	
1102		.0000E 00	
1103		.0000E 00	
1104		.0000E 00	
1105		.0000E 00	
1106		.0000E 00	
1107		.0000E 00	
1108		.0000E 00	
1109		.0000E 00	
1110		.0000E 00	
1111		.0000E 00	
1112		.0000E 00	
1113		.0000E 00	
1114		.0000E 00	
1115		.0000E 00	
1116		.0000E 00	
1117		.0000E 00	
1118		.3100E 01	
1119		.5724E 02	
1120		.0000E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1121		.0000E 00	
1122		.0000E 00	
1123		.0000E 00	
1124		.0000E 00	
1125		.0000E 00	
1126		.0000E 00	
1127		.0000E 00	
1128		.0000E 00	
1129		.0000E 00	
1130		.0000E 00	
1131		.0000E 00	
1132		.0000E 00	
1133		.0000E 00	
1134		.0000E 00	
1135		.0000E 00	
1136		.0000E 00	
1137		.0000E 00	
1138		.0000E 00	
1139		.0000E 00	
1140		.0000E 00	
1141		.0000E 00	
1142		.0000E 00	
1143		.0000E 00	
1144		.0000E 00	
1145		.0000E 00	
1146		.0000E 00	
1147		.0000E 00	
1148		.0000E 00	
1149		.0000E 00	
1150		.0000E 00	
1151		.0000E 00	
1152		.0000E 00	
1153		.0000E 00	
1154		.0000E 00	
1155		.0000E 00	
1156		.0000E 00	
1157		.0000E 00	
1158		.0000E 00	
1159		.0000E 00	
1160		.0000E 00	
1161		.0000E 00	
1162		.0000E 00	
1163		.0000E 00	
1164		.0000E 00	
1165		.0000E 00	
1166		.0000E 00	
1167		.0000E 00	
1168		.0000E 00	
1169		.0000E 00	
1170		.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1171		.0000E 00	
1172		.0000E 00	
1173		.0000E 00	
1174		.0000E 00	
1175		.0000E 00	
1176		.0000E 00	
1177		.0000E 00	
1178		.0000E 00	
1179		.0000E 00	
1180		.0000E 00	
1181		.0000E 00	
1182		.0000E 00	
1183		.0000E 00	
1184		.0000E 00	
1185		.0000E 00	
1186		.0000E 00	
1187		.0000E 00	
1188		.0000E 00	
1189		.0000E 00	
1190		.0000E 00	
1191		.0000E 00	
1192		.0000E 00	
1193		.0000E 00	
1194		.0000E 00	
1195		.0000E 00	
1196		.0000E 00	
1197		.0000E 00	
1198		.0000E 00	
1199		.0000E 00	
1200		.0000E 00	
1201 FWHITU (25)	UPPER HORIZ. TAIL DOWNWASH VS. MAIN MOTOR WAKE ANGLE	.0000E 00	
1202		.0000E 00	
1203		.0000E 00	
1204		.0000E 00	
1205		.0000E 00	
1206		.0000E 00	
1207		.0000E 00	
1208		.0000E 00	
1209		.0000E 00	
1210		.0000E 00	
1211		.0000E 00	
1212		.0000E 00	
1213		.0000E 00	
1214		.0000E 00	
1215		.0000E 00	
1216		.0000E 00	
1217		.0000E 00	
1218		.0000E 00	

TABLE 1. - Continued

Q/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1210		.0000E 00	
1220		.0000E 00	
1221		.0000E 00	
1222		.0000E 00	
1223		.0000E 00	
1224		.0000E 00	
1225		.0000E 00	
1226	***OPEN***(15)		
1227			
1228			
1229			
1230			
1231			
1232			
1233			
1234			
1235			
1236			
1237			
1238			
1239			
1240			
1241	BLADK (9) BLADE STIFFNESS MATRIX (3,3) ARRAY	.1391E 02	
1242		.6061E-02	
1243		.5023E 00	
1244		.6061E-02	
1245		.1327E-01	
1246		.1271E 01	
1247		.5023E 00	
1248		.1271E 01	
1249		.5201E 03	
1250	CTRM BLADE MODE DAMPING AFTER 1 SEC OF TRIM	.5700E-03	F-LB/R/S
1251	CFLY BLADE MODE DAMPING DURING FLY	.5700E-03	F-LB/R/S
1252	CZEM BLADE MODE DAMPING AT TRIM INITIALIZATION	.5700E-03	F-LB/R/S
1253	CONK TAIL ROTOR (DELTA 3) FLAP FEATHERING COUPLING	.0000E 00	
1254	***OPEN***(2)		
1255			

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1256 DCMH	INCREMENTAL BLADE CM FNR TAN	.0000E 00	
1257 INAFLG	HARMONIC ANALYSIS FLAG (NOT ACTIVE)	.1000E 01	
1258 **OPEN** (5)			
1259			
1260			
1261			
1262			
1263 DGONG	S&P ROTARY-TO-VERT. DAMPING LB/(FT-LB-RAD)	.0000E 00	
1264 DELCO	BLADE ELEMENT CD ADJUSTMENT	.0000E 00	
1265 **OPEN**			
1266 BETA	BLADE CUNE ANGLE	.0000E 00	DEG
1267 TAN	BLADE SWEEP ANGLE +FWD	.0000E 00	DEG
1268 GAMMA	BLADE DROOP ANGLE +DN	.0000E 00	DEG
1269 PHREF	BLADE REFERENCE FEATHER ANGLE +N,UP	.1500E 02	DEG
1270 HFAS	BLADE BEAKING CUNE ANGLE +UP	.0000E 00	DEG
1271 **OPEN** (5)			
1272			
1273			
1274			
1275			
1276 GASTOP	S&P STOP CONTACT ANGLE	.5000E 00	RAD
1277 GASTOP	S&P STOP SPRING CONSTANT	.0000E 00	FT-LB/RD
1278 **OPEN** (13)			
1279			
1280			
1281			
1282			
1283			
1284			
1285			
1286			
1287			
1288			

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1289			
1290			
1291 SS	SPEED OF SOUND	.1098E 04	FT/SEC
1292 **OPEN** (9)			
1293			
1294			
1295			
1296			
1297			
1298			
1299			
1300			
1301 CVP (10)	TRIM CONTROL PARAMETER POINTER TABLE	.1100E 02	
1302		.1300E 02	
1303		.7000E 01	
1304		.9000E 01	
1305		.8000E 01	
1306		.1000E 02	
1307		.0000E 00	
1308		.0000E 00	
1309		.0000E 00	
1310		.0000E 00	
1311 FUNC (10)	TRIM CONTROL FUNCTION POINTER TABLE	.3000E 01	
1312		.1000E 01	
1313		.2000E 01	
1314		.4000E 01	
1315		.5000E 01	
1316		.6000E 01	
1317		.0000E 00	
1318		.0000E 00	
1319		.0000E 00	
1320		.0000E 00	
1321 CVE (10)	TRIM CONVERGENCE ERROR TABLE	.1000E-02	
1322		.1000E-01	
1323		.1000E-01	
1324		.4000E-02	
1325		.3000E-02	
1326		.1000E-02	
1327		.0000E 00	
1328		.0000E 00	
1329		.0000E 00	
1330		.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1331 CVK (10)	TRIM GAINS	-.1600E-02	
1332		-.1600E-02	
1333		.3000E-01	
1334		.4180E-01	
1335		.8356E-01	
1336		-.7500E-01	
1337		.0000E 00	
1338		.0000E 00	
1339		.0000E 00	
1340		.0000E 00	
1341 **OPEN** (4)			
1342			
1343			
1344			
1345 KTI	BLADE INBOARD TAB STATION NO.	.0000E 00	
1346 KTO	BLADE OUTBOARD TAB STATION NO.	.0000E 00	
1347 **OPEN**			
1348 HTR	HEIGHT OF TAIL ROTOR +UP	.4750E 01	FT
1349 PTP1	ENGINE THRUST POLYNOMIAL COEFF QUADRATIC TERM	.0000E 00	
1350 PTP2	LINEAR TERM	.0000E 00	
1351 PTP3	CONSTANT TERM	.0000E 00	
1352 AIP	THRUST LINE PITCH ANGLE WRT FUSELAGE	.0000E 00	DEG
1353 HP	THRUSTOR POSITION ABOVE FUSELAGE REF.	.0000E 00	FT
1354 SLP	THRUSTOR POSITION	.0000E 00	FT
1355 **OPEN** (6)			
1356			
1357			
1358			
1359			
1360			
1361 OSOGJ (20)	RECIPROCAL OF TORSIONAL STIFFNESS GJ	.0000E 00	
1362		.0000E 00	
1363		.0000E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1364		.0000E 00	
1365		.0000E 00	
1366		.0000E 00	
1367		.0000E 00	
1368		.0000E 00	
1369		.0000E 00	
1370		.0000E 00	
1371		.0000E 00	
1372		.0000E 00	
1373		.0000E 00	
1374		.0000E 00	
1375		.0000E 00	
1376		.0000E 00	
1377		.0000E 00	
1378		.0000E 00	
1379		.0000E 00	
1380		.0000E 00	
1381 **OPEN** (20)			
1382			
1383			
1384			
1385			
1386			
1387			
1388			
1389			
1390			
1391			
1392			
1393			
1394			
1395			
1396			
1397			
1398			
1399			
1400			
1401 TCT	QUASI-STATIC TENSION TIME CONSTANT	.0000E 00	SEC
1402 **OPEN** (10)			
1403			
1404			
1405			
1406			
1407			
1408			
1409			

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TABLE 1. - Continued

R/A	PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1410				
1411				
1412				
1413				
1414				
1415				
1416				
1417				
1418				
1419				
1420				
1421	VSC (20)	DIST. C.G. TO SHEAR CENTER +F=2	.0000E 00	FT
1422			.0000E 00	FT
1423			.0000E 00	FT
1424			.0000E 00	FT
1425			.0000E 00	FT
1426			.0000E 00	FT
1427			.0000E 00	FT
1428			.0000E 00	FT
1429			.0000E 00	FT
1430			.0000E 00	FT
1431			.0000E 00	FT
1432			.0000E 00	FT
1433			.0000E 00	FT
1434			.0000E 00	FT
1435			.0000E 00	FT
1436			.0000E 00	FT
1437			.0000E 00	FT
1438			.0000E 00	FT
1439			.0000E 00	FT
1440			.0000E 00	FT
1441	VNA (20)	LOC. OF NEUTRAL AXIS RELATIVE TO 1/4 CHORD +F=0	.0000E 00	FT
1442			.0000E 00	FT
1443			.0000E 00	FT
1444			.0000E 00	FT
1445			.0000E 00	FT
1446			.0000E 00	FT
1447			.0000E 00	FT
1448			.0000E 00	FT
1449			.0000E 00	FT
1450			.0000E 00	FT
1451			.0000E 00	FT
1452			.0000E 00	FT
1453			.0000E 00	FT
1454			.0000E 00	FT
1455			.0000E 00	FT

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1456		.0000E 00	FT
1457		.0000E 00	FT
1458		.0000E 00	FT
1459		.0000E 00	FT
1460		.0000E 00	FT
1461 IXXF	FUSELAGE MOM INERTIA,ROLL	.5895E 04	SLUG-FT2
1462 IYVF	FUSELAGE MOM INERTIA,PITCH	.2750E 05	SLUG-FT2
1463 IZZF	FUSELAGE MOM INERTIA,YAW	.2309E 05	SLUG-FT2
1464 IXVF	FUSELAGE MOM INERTIA,R - P	.0000E 00	SLUG-FT2
1465 IYZF	FUSELAGE MOM INERTIA,R - Y	.0000E 00	SLUG-FT2
1466 IYZF	FUSELAGE MOM INERTIA,P - Y	.0000E 00	SLUG-FT2
1467 **OPEN**			
1468 IZZH	HUB POLAR INERTIA	.0000E 00	SLUG-FT2
1469 ZSPZ	HUB-TO-SNAPPLATE C.G.	.0000E 00	FT
1470 **OPEN**			
1471 IXXENG	ENGINE MOMENT OF INERTIA	.0000E 00	SLUG-FT2
1472 IYYTR	TAIL ROTOR MOMENT OF INERTIA	.1000E 02	SLUG-FT2
1473 GRXF	GEAR RATIO TAIL FIN (NOT ACTIVE)	.0000E 00	
1474 GRXG	GEAR RATIO ENGINE +TOP LT	.1000E 01	
1475 GRTH	TAIL ROTOR +TOP RT	.0000E 01	
1476 **OPEN**			
1477 ZPHN	PITCH HORN PARTIAL	.1000E 01	
1478 ARPH	DYNAMIC PITCH HORN SPRING	.1000E 05	FT-LB/IN
1479 DELZOH	OUTBOARD HEARING OFFSET ADJUSTMENT +UP	.0000E 00	FT
1480 IPHONN		.0000E 00	
1481 YJOG	BLADE CHORDWISE OFFSET + TIP END	.0000E 00	FT

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1482 ZJOG	WAGE FLAPWISE OFFSET + TIP UP	.0000E 00	FT
1483 **OPEN**			
1484 ENHPE	MAXIMUM ENGINE HORSEPOWER	.0000E 00	
1485 CFM	FEATHERING VISCOUS FRICTION	.0000E 00	F-LB/R/S
1486 **OPEN**			
1487 RPH	QUASI-STATIC PITCH HORN SPRING AND FLAG, ORNU UIASI	.0000E 00	FT-L3/R0
1488 TPH	QUASI-STATIC PITCH HORN TIME CONSTANT	.0000E 00	SEC
1489 **OPEN** (5)			
1490			
1491			
1492			
1493			
1494 FIDDLE	SAP VERTICAL CENTERING	.0000E 00	LB
1495 **OPEN** (2)			
1496			
1497 TORFLG	QUASI-STATIC TENSION FLAG 0=OFF, 1=ON	.0000E 00	
1498 TSTOP	FLY TRAJ. CUTOFF TIME	.3000E 00	SEC
1499 **OPEN**			
1500 NSIGNALS	NO. OF SIGNALS IN SIGNAL SAVE SET	.1260E 03	
1501 SLUC (200)	OUTPUT SIGNAL POINTER TABLE	.2A72E 04	
1502		.2A73E 04	
1503		.2A74E 04	
1504		.2A75E 04	
1505		.1530E 03	
1506		.1540E 03	
1507		.2A76E 04	
1508		.2A50E 04	
1509		.2A58E 04	
1510		.2A70E 04	
1511		.2A71E 04	
1512		.2A65E 04	

TABLE 1. - Continued

N/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1513		.2863E 04	
1514		.2862E 04	
1515		.2864E 04	
1516		.2866E 04	
1517		.2867E 04	
1518		.2868E 04	
1519		.2869E 04	
1520		.2870E 04	
1521		.2877E 04	
1522		.2130E 03	
1523		.2140E 03	
1524		.2150E 03	
1525		.2340E 03	
1526		.2350E 03	
1527		.2360E 03	
1528		.2550E 03	
1529		.2560E 03	
1530		.2570E 03	
1531		.2760E 03	
1532		.2878E 04	
1533		.2879E 04	
1534		.2880E 04	
1535		.2881E 04	
1536		.4588E 03	
1537		.4590E 03	
1538		.4600E 03	
1539		.4610E 03	
1540		.4620E 03	
1541		.4630E 03	
1542		.4710E 03	
1543		.4220E 03	
1544		.4830E 03	
1545		.3660E 03	
1546		.3670E 03	
1547		.3680E 03	
1548		.3720E 03	
1549		.3730E 03	
1550		.3740E 03	
1551		.3770E 03	
1552		.3280E 03	
1553		.3290E 03	
1554		.3420E 03	
1555		.3430E 03	
1556		.3440E 03	
1557		.3450E 03	
1558		.3460E 03	
1559		.3470E 03	
1560		.3300E 03	
1561		.3310E 03	
1562		.3320E 03	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1563		.3330E 03	
1564		.3340E 03	
1565		.3350E 03	
1566		.1A60E 03	
1567		.1670E 03	
1568		.1A80E 03	
1569		.3A70E 03	
1570		.3A80E 03	
1571		.3A90E 03	
1572		.0A10E 03	
1573		.0A20E 03	
1574		.0A30E 03	
1575		.0700E 03	
1576		.0710E 03	
1577		.0720E 03	
1578		.0730E 03	
1579		.0740E 03	
1580		.0750E 03	
1581		.3A40E 03	
1582		.3A50E 03	
1583		.3A60E 03	
1584		.2A02E 04	
1585		.2100E 03	
1586		.2170E 03	
1587		.2180E 03	
1588		.2190E 03	
1589		.2200E 03	
1590		.2210E 03	
1591		.2220E 03	
1592		.2230E 03	
1593		.2240E 03	
1594		.2250E 03	
1595		.2260E 03	
1596		.2270E 03	
1597		.31A0E 03	
1598		.3190E 03	
1599		.2A72E 04	
1600		.2A73E 04	
1601		.2A75E 04	
1602		.0A80E 03	
1603		.0A60E 03	
1604		.0510E 03	
1605		.0A20E 03	
1606		.0A00E 03	
1607		.0A40E 03	
1608		.0A30E 03	
1609		.0A80E 03	
1610		.2A59E 04	
1611		.2A58E 04	
1612		.2870E 04	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1613		.2871E	04
1614		.2865E	04
1615		.2878E	04
1616		.2879E	04
1617		.2880E	04
1618		.3620E	03
1619		.4700E	03
1620		.2891E	04
1621		.2892E	04
1622		.2893E	04
1623		.2894E	04
1624		.2895E	04
1625		.2896E	04
1626		.2897E	04
1627		.0000E	00
1628		.0000E	00
1629		.0000E	00
1630		.0000E	00
1631		.0000E	00
1632		.0000E	00
1633		.0000E	00
1634		.0000E	00
1635		.0000E	04
1636		.0000E	00
1637		.0000E	00
1638		.0000E	00
1639		.0000E	00
1640		.0000E	00
1641		.0000E	00
1642		.0000E	00
1643		.0000E	00
1644		.0000E	00
1645		.0000E	00
1646		.0000E	00
1647		.0000E	00
1648		.0000E	00
1649		.0000E	00
1650		.0000E	00
1651		.0000E	00
1652		.0000E	00
1653		.0000E	00
1654		.0000E	00
1655		.0000E	00
1656		.0000E	00
1657		.0000E	00
1658		.0000E	00
1659		.0000E	00
1660		.0000E	00
1661		.0000E	00
1662		.0000E	00

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1663		.0000E 00	
1664		.0000E 00	
1665		.0000E 00	
1666		.0000E 00	
1667		.0000E 00	
1668		.0000E 00	
1669		.0000E 00	
1670		.0000E 00	
1671		.0000E 00	
1672		.0000E 00	
1673		.0000E 00	
1674		.0000E 00	
1675		.0000E 00	
1676		.0000E 00	
1677		.0000E 00	
1678		.0000E 00	
1679		.0000E 00	
1680		.0000E 00	
1681		.0000E 00	
1682		.0000E 00	
1683		.0000E 00	
1684		.0000E 00	
1685		.0000E 00	
1686		.0000E 00	
1687		.0000E 00	
1688		.0000E 00	
1689		.0000E 00	
1690		.0000E 00	
1691		.0000E 00	
1692		.0000E 00	
1693		.0000E 00	
1694		.0000E 00	
1695		.0000E 00	
1696		.0000E 00	
1697		.0000E 00	
1698		.0000E 00	
1699		.0000E 00	
1700		.0000E 00	
1701	**OPEN** (50)		
1702			
1703			
1704			
1705			
1706			
1707			
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1709			
1710			
1711			

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1712			
1713			
1714			
1715			
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1720			
1721			
1722			
1723			
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1740			
1741			
1742			
1743			
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1745			
1746			
1747			
1748			
1749			
1750			
1751 FARM (25)	FUSELAGE DOWNWASH AS A FUNCT. OF MAIN MOTOR WAKE ANGLE	.1400E 02	
1752		-.1400E 03	
1753		.6230E 00	
1754		.6000E 00	
1755		.6230E 00	
1756		.4000E 02	
1757		.7400E 00	
1758		.7000E 02	
1759		.4400E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1760		.0000E 02	
1761		.0600E 00	
1762		.0000E 02	
1763		.0400E 00	
1764		.1000E 03	
1765		.5000E 00	
1766		.1100E 03	
1767		.3450E 00	
1768		.1000E 03	
1769		.3030E 00	
1770		.0000E 00	
1771		.0000E 00	
1772		.0000E 00	
1773		.0000E 00	
1774		.0000E 00	
1775		.0000E 00	
1776 FARMY (25)	HORIZ TAIL DOWNWASH VS. MAIN ROTOR WAKE ANGLE	.2200E 02	
1777		.1000E 03	
1778		.0000E 00	
1779		.2000E 02	
1780		.0000E 00	
1781		.5000E 02	
1782		.2000E 01	
1783		.6000E 02	
1784		.1920E 01	
1785		.7400E 02	
1786		.1520E 01	
1787		.0000E 02	
1788		.1340E 01	
1789		.9000E 02	
1790		.1140E 01	
1791		.1000E 03	
1792		.1000E 01	
1793		.1100E 03	
1794		.1000E 01	
1795		.1200E 03	
1796		.9000E 00	
1797		.1000E 03	
1798		.0000E 00	
1799		.0000E 00	
1800		.0000E 00	
1801 NVEC (100)	PLOT SIGNAL POINTER TABLE	.0001E 04	
1802		.2002E 04	
1803		.0003E 04	
1804		.4110E 04	
1805		.1000E 04	
1806		.7009E 04	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1807		.4010E	04
1808		.4007E	04
1809		.1005E	04
1810		.2006E	04
1811		.1100E	02
1812		.1206E	02
1813		.4013E	04
1814		.4014E	04
1815		.1015E	04
1816		.2000E	02
1817		.0066E	04
1818		.1067E	04
1819		.5068E	04
1820		.1069E	04
1821		.2070E	04
1822		.4071E	04
1823		.1072E	04
1824		.6074E	04
1825		.1041E	04
1826		.2042E	04
1827		.4043E	04
1828		.1044E	04
1829		.2040E	04
1830		.1041E	04
1831		.0045E	04
1832		.1046E	04
1833		.5047E	04
1834		.1048E	04
1835		.2049E	04
1836		.4050E	04
1837		.1051E	04
1838		.2052E	04
1839		.5053E	04
1840		.0054E	04
1841		.1055E	04
1842		.5056E	04
1843		.1057E	04
1844		.2058E	04
1845		.4059E	04
1846		.0060E	04
1847		.1061E	04
1848		.5062E	04
1849		.3020E	04
1850		.3021E	04
1851		.2200E	02
1852		.2300E	02
1853		.4042E	04
1854		.0043E	04
1855		.2044E	04
1856		.2031E	04

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1857		.6030E 04	
1858		.1037E 04	
1859		.5030E 04	
1860		.1030E 04	
1861		.3200E 02	
1862		.3300E 02	
1863		.3400E 02	
1864		.3500E 02	
1865		.0000E 00	
1866		.0000E 00	
1867		.0000E 00	
1868		.0000E 00	
1869		.0000E 00	
1870		.0000E 00	
1871		.0000E 00	
1872		.0000E 00	
1873		.0000E 00	
1874		.0000E 00	
1875		.0000E 00	
1876		.0000E 00	
1877		.0000E 00	
1878		.0000E 00	
1879		.0000E 00	
1880		.0000E 00	
1881		.0000E 00	
1882		.0000E 00	
1883		.0000E 00	
1884		.0000E 00	
1885		.0000E 00	
1886		.0000E 00	
1887		.0000E 00	
1888		.0000E 00	
1889		.0000E 00	
1890		.0000E 00	
1891		.0000E 00	
1892		.0000E 00	
1893		.0000E 00	
1894		.0000E 00	
1895		.0000E 00	
1896		.0000E 00	
1897		.0000E 00	
1898		.0000E 00	
1899		.0000E 00	
1900		.0000E 00	
1901	**OPEN** (40)		
1902			
1903			
1904			
1905			

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1906			
1907			
1908			
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1911			
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1914			
1915			
1916			
1917			
1918			
1919			
1920			
1921			
1922			
1923			
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1929			
1930			
1931			
1932			
1933			
1934			
1935			
1936			
1937			
1938			
1939			
1940			
1941 SASDX (7)	SAS DATA FOR X-STICK	.0000E 00	
1942		.0000E 00	
1943		.0000E 00	
1944		.0000E 00	
1945		.0000E 00	
1946		.0000E 00	
1947		.0000E 00	
1948 SASDY (7)	SAS DATA FOR Y-STICK	.0000E 00	
1949		.0000E 00	
1950		.0000E 00	
1951		.0000E 00	
1952		.0000E 00	
1953		.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1954		.0000E 0	
1955 SASDEL (7)	SAS DATA FOR ELEVATOR CONTR.	.0000E 00	
1956		.0000E 00	
1957		.0000E 00	
1958		.0000E 00	
1959		.0000E 00	
1960		.0000E 00	
1961		.0000E 00	
1962 SASDAL (7)	SAS DATA FOR AILERON CONTR.	.0000E 00	
1963		.0000E 00	
1964		.0000E 00	
1965		.0000E 00	
1966		.0000E 00	
1967		.0000E 00	
1968		.0000E 00	
1969 SASDTR (7)	SAS DATA FOR TAIL ROTOR CON.	.0000E 00	
1970		.0000E 00	
1971		.0000E 00	
1972		.0000E 00	
1973		.0000E 00	
1974		.0000E 00	
1975		.0000E 00	
1976 SASDRD (7)	SAS DATA FOR RUDDER CONTR.	.0000E 00	
1977		.0000E 00	
1978		.0000E 00	
1979		.0000E 00	
1980		.0000E 00	
1981		.0000E 00	
1982		.0000E 00	
1983 KXCFS	FT LONG. STICK FOR 100 PERCENT INPUT	.1000E 01	
1984 KYCFS	FT LAT. STICK FOR 100 PERCENT INPUT	.1000E 01	
1985 KELFS	RADIANS OF ELEVATOR DEFLECT. FOR 100 PERCENT INPUT	.0000E 00	
1986 KALFS	RADIANS OF AILERON DEFLECT. FOR 100 PERCENT INPUT	.0000E 00	
1987 KTRFS	RADIANS OF TAIL ROTOR COLL. FOR 100 PERCENT INPUT	.1000E 01	
1988 KRUDFS	RADIANS OF RUDDER FOR 100 PERCENT PEDALS	.0000E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
1960 NIMFS	RADIANS OF COLLECTIVE FOR 100 PERCENT STICK	.1000E 01	
1990 NPFS	RADIANS OF ENGINE FUEL CONTR. FOR 100 PERCENT MOVEMENT	.0000E 00	
1991 NDMFS	RADIANS OF DIVERBANK ROTATION FOR 100 PERCENT MOVEMENT	.0000E 00	
1992 NPLFS	RADIANS OF FLAP MOTION FOR 100 PERCENT MOVEMENT	.0000E 00	
1993 NIMFS	RADIANS OF WING INCIDENCE FOR 100 PERCENT MOVEMENT	.0000E 00	
1994 NIMFS	RADIANS OF HORIZ. TAIL INCID. FOR 100 PERCENT MOVEMENT	.0000E 00	
1995 00000000 (0)			
1996			
1997			
1998			
1999			
2000			
2001 THTUNS (140)	TWIN SAVE DATA (20,7) ARRAY BLADE TUNSTON DISPL.	.0000E 00	RAO
2002		.0000E 00	RAO
2003		.0000E 00	RAO
2004		.0000E 00	RAO
2005		.0000E 00	RAO
2006		.0000E 00	RAO
2007		.0000E 00	RAO
2008		.0000E 00	RAO
2009		.0000E 00	RAO
2010		.0000E 00	RAO
2011		.0000E 00	RAO
2012		.0000E 00	RAO
2013		.0000E 00	RAO
2014		.0000E 00	RAO
2015		.0000E 00	RAO
2016		.0000E 00	RAO
2017		.0000E 00	RAO
2018		.0000E 00	RAO
2019		.0000E 00	RAO
2020		.0000E 00	RAO
2021		.0000E 00	RAO
2022		.0000E 00	RAO
2023		.0000E 00	RAO
2024		.0000E 00	RAO

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TABLE 1. - Continued

N/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2025		.0000E 00	WAD
2026		.0000E 00	WAD
2027		.0000E 00	WAD
2028		.0000E 00	WAD
2029		.0000E 00	WAD
2030		.0000E 00	WAD
2031		.0000E 00	WAD
2032		.0000E 00	WAD
2033		.0000E 00	WAD
2034		.0000E 00	WAD
2035		.0000E 00	WAD
2036		.0000E 00	WAD
2037		.0000E 00	WAD
2038		.0000E 00	WAD
2039		.0000E 00	WAD
2040		.0000E 00	WAD
2041		.0000E 00	WAD
2042		.0000E 00	WAD
2043		.0000E 00	WAD
2044		.0000E 00	WAD
2045		.0000E 00	WAD
2046		.0000E 00	WAD
2047		.0000E 00	WAD
2048		.0000E 00	WAD
2049		.0000E 00	WAD
2050		.0000E 00	WAD
2051		.0000E 00	WAD
2052		.0000E 00	WAD
2053		.0000E 00	WAD
2054		.0000E 00	WAD
2055		.0000E 00	WAD
2056		.0000E 00	WAD
2057		.0000E 00	WAD
2058		.0000E 00	WAD
2059		.0000E 00	WAD
2060		.0000E 00	WAD
2061		.0000E 00	WAD
2062		.0000E 00	WAD
2063		.0000E 00	WAD
2064		.0000E 00	WAD
2065		.0000E 00	WAD
2066		.0000E 00	WAD
2067		.0000E 00	WAD
2068		.0000E 00	WAD
2069		.0000E 00	WAD
2070		.0000E 00	WAD
2071		.0000E 00	WAD
2072		.0000E 00	WAD
2073		.0000E 00	WAD
2074		.0000E 00	WAD
2075		.0000E 00	WAD

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2075		.4000E 00	RAD
2076		.9000E 00	RAD
2077		.0000E 00	RAD
2078		.0000E 00	RAD
2079		.0000E 00	RAD
2080		.0000E 00	RAD
2081		.0000E 00	RAD
2082		.0000E 00	RAD
2083		.0000E 00	RAD
2084		.0000E 00	RAD
2085		.0000E 00	RAD
2086		.0000E 00	RAD
2087		.0000E 00	RAD
2088		.0000E 00	RAD
2089		.0000E 00	RAD
2090		.0000E 00	RAD
2091		.0000E 00	RAD
2092		.0000E 00	RAD
2093		.0000E 00	RAD
2094		.0000E 00	RAD
2095		.0000E 00	RAD
2096		.0000E 00	RAD
2097		.0000E 00	RAD
2098		.0000E 00	RAD
2099		.0000E 00	RAD
2100		.0000E 00	RAD
2101		.0000E 00	RAD
2102		.0000E 00	RAD
2103		.0000E 00	RAD
2104		.0000E 00	RAD
2105		.0000E 00	RAD
2106		.0000E 00	RAD
2107		.0000E 00	RAD
2108		.0000E 00	RAD
2109		.0000E 00	RAD
2110		.0000E 00	RAD
2111		.0000E 00	RAD
2112		.0000E 00	RAD
2113		.0000E 00	RAD
2114		.0000E 00	RAD
2115		.0000E 00	RAD
2116		.0000E 00	RAD
2117		.0000E 00	RAD
2118		.0000E 00	RAD
2119		.0000E 00	RAD
2120		.0000E 00	RAD
2121		.0000E 00	RAD
2122		.0000E 00	RAD
2123		.0000E 00	RAD
2124		.0000E 00	RAD

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2125		.0000E 00	RAD
2126		.0000E 00	RAD
2127		.0000E 00	RAD
2128		.0000E 00	RAD
2129		.0000E 00	RAD
2130		.0000E 00	RAD
2131		.0000E 00	RAD
2132		.0000E 00	RAD
2133		.0000E 00	RAD
2134		.0000E 00	RAD
2135		.0000E 00	RAD
2136		.0000E 00	RAD
2137		.0000E 00	RAD
2138		.0000E 00	RAD
2139		.0000E 00	RAD
2140		.0000E 00	RAD
2141 V	(21) HENDING MODE INIT. CONDITIONS (3,7) DISPL.	-.0129E 01	
2142		-.2722E 01	
2143		-.2000E-01	
2144		-.0000E 01	
2145		-.5970E 01	
2146		.1714E 00	
2147		-.0449E 01	
2148		-.1632E 01	
2149		.1575E 00	
2150		-.0447E 01	
2151		.1249E 01	
2152		.1873E 00	
2153		.0000E 00	
2154		.0000E 00	
2155		.0000E 00	
2156		.0000E 00	
2157		.0000E 00	
2158		.0000E 00	
2159		.0000E 00	
2160		.0000E 00	
2161		.0000E 00	
2162 VD	(21) (3,7) VELOCITIES	-.1150E 02	
2163		.0500E 02	
2164		-.1262E 01	
2165		.1003E 02	
2166		-.1320E 02	
2167		-.2040E 00	
2168		-.1005E 00	
2169		-.3031E 01	
2170		-.0113E-01	
2171		.3122E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2172		.1190E 02	
2173		.1322E 01	
2174		.0000E 00	
2175		.0000E 00	
2176		.0000E 00	
2177		.0000E 00	
2178		.0000E 00	
2179		.0000E 00	
2180		.0000E 00	
2181		.0000E 00	
2182		.0000E 00	
2183	VNO (21) (3,7) ACCELERATIONS	.2697E 02	
2184		.1604E 03	
2185		.2200E 03	
2186		-.1575E 02	
2187		.2113E 04	
2188		-.7047E 02	
2189		.1404E 03	
2190		-.5009E 03	
2191		.1443E 02	
2192		.1200E 02	
2193		-.1712E 04	
2194		-.1004E 03	
2195		.0000E 00	
2196		.0000E 00	
2197		.0000E 00	
2198		.0000E 00	
2199		.0000E 00	
2200		.0000E 00	
2201		.0000E 00	
2202		.0000E 00	
2203		.0000E 00	
2204	***OPEN*** (00)		
2205			
2206			
2207			
2208			
2209			
2210			
2211			
2212			
2213			
2214			
2215			
2216			
2217			
2218			
2219			

ORIGINAL PAGE IS
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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2220			
2221			
2222			
2223			
2224			
2225			
2226			
2227			
2228			
2229			
2230			
2231			
2232			
2233			
2234			
2235			
2236			
2237			
2238			
2239			
2240			
2241			
2242			
2243			
2244			
2245			
2246			
2247			
2248			
2249			
2250			
2251			
2252			
2253			
2254			
2255			
2256			
2257			
2258			
2259			
2260			
2261			
2262			
2263			
2264			
2265			
2266			
2267			
2268			
2269			

TABLE 1. - Continued

P/A SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2270			
2271			
2272			
2273			
2274			
2275			
2276			
2277			
2278			
2279			
2280			
2281			
2282			
2283			
2284			
2285			
2286			
2287			
2288			
2289			
2290			
2291			
2292			
2293			
2294			
2295			
2296			
2297			
2298			
2299			
2300 UNSIG	N.O. OF SIGNALS TO HARMONICALLY ANALYZE.	.1190E 02	
2301 MSIG (50)	N.O. SIGNAL POINTER TABLE	.1190E 03	
2302		.3800E 02	
2303		.3900E 02	
2304		.4000E 02	
2305		.1200E 03	
2306		.1210E 03	
2307		.1220E 03	
2308		.1230E 03	
2309		.1240E 03	
2310		.1250E 03	
2311		.1260E 03	
2312		.0000E 00	
2313		.0000E 00	
2314		.0000E 00	
2315		.0000E 00	
2316		.0000E 00	

ORIGINAL PAGE IS
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TABLE 1. - Continued

P/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2317		.0000E 00	
2318		.0000E 00	
2319		.0000E 00	
2320		.0000E 00	
2321		.0000E 00	
2322		.0000E 00	
2323		.0000E 00	
2324		.0000E 00	
2325		.0000E 00	
2326		.0000E 00	
2327		.0000E 00	
2328		.0000E 00	
2329		.0000E 00	
2330		.0000E 00	
2331		.0000E 00	
2332		.0000E 00	
2333		.0000E 00	
2334		.0000E 00	
2335		.0000E 00	
2336		.0000E 00	
2337		.0000E 00	
2338		.0000E 00	
2339		.0000E 00	
2340		.0000E 00	
2341		.0000E 00	
2342		.0000E 00	
2343		.0000E 00	
2344		.0000E 00	
2345		.0000E 00	
2346		.0000E 00	
2347		.0000E 00	
2348		.0000E 00	
2349		.0000E 00	
2350		.0000E 00	
2351	***OPEN** (50)		
2352			
2353			
2354			
2355			
2356			
2357			
2358			
2359			
2360			
2361			
2362			
2363			
2364			
2365			

TABLE 1. - Continued

N/A	PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2366				
2367				
2368				
2369				
2370				
2371				
2372				
2373				
2374				
2375				
2376				
2377				
2378				
2379				
2380				
2381				
2382				
2383				
2384				
2385				
2386				
2387				
2388				
2389				
2390				
2391				
2392				
2393				
2394				
2395				
2396				
2397				
2398				
2399				
2400				
2401	SVEC	(100) PLOT SIGNAL SCALE FACTORS	.0000E 00	
2402			.0000E 00	
2403			.0000E 00	
2404			.0000E 00	
2405			.0000E 00	
2406			.0000E 00	
2407			.0000E 00	
2408			.0000E 00	
2409			.0000E 00	
2410			.0000E 00	
2411			.0000E 00	
2412			.0000E 00	
2413			.0000E 00	
2414			.0000E 00	

ORIGINAL PAGE IS
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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2415		.0000E 00	
2416		.0000E 00	
2417		.0000E 00	
2418		.0000E 00	
2419		.0000E 00	
2420		.0000E 00	
2421		.0000E 00	
2422		.0000E 00	
2423		.0000E 00	
2424		.0000E 00	
2425		.0000E 00	
2426		.0000E 00	
2427		.0000E 00	
2428		.0000E 00	
2429		.0000E 00	
2430		.0000E 00	
2431		.0000E 00	
2432		.0000E 00	
2433		.0000E 00	
2434		.0000E 00	
2435		.0000E 00	
2436		.0000E 00	
2437		.0000E 00	
2438		.0000E 00	
2439		.0000E 00	
2440		.0000E 00	
2441		.0000E 00	
2442		.0000E 00	
2443		.0000E 00	
2444		.0000E 00	
2445		.0000E 00	
2446		.0000E 00	
2447		.0000E 00	
2448		.0000E 00	
2449		.0000E 00	
2450		.0000E 00	
2451		.0000E 00	
2452		.0000E 00	
2453		.0000E 00	
2454		.0000E 00	
2455		.0000E 00	
2456		.0000E 00	
2457		.0000E 00	
2458		.0000E 00	
2459		.0000E 00	
2460		.0000E 00	
2461		.0000E 00	
2462		.0000E 00	
2463		.0000E 00	
2464		.0000E 00	

TABLE 1. - Continued

N/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2465		.0000E 00	
2466		.0000E 00	
2467		.0000E 00	
2468		.0000E 00	
2469		.0000E 00	
2470		.0000E 00	
2471		.0000E 00	
2472		.0000E 00	
2473		.0000E 00	
2474		.0000E 00	
2475		.0000E 00	
2476		.0000E 00	
2477		.0000E 00	
2478		.0000E 00	
2479		.0000E 00	
2480		.0000E 00	
2481		.0000E 00	
2482		.0000E 00	
2483		.0000E 00	
2484		.0000E 00	
2485		.0000E 00	
2486		.0000E 00	
2487		.0000E 00	
2488		.0000E 00	
2489		.0000E 00	
2490		.0000E 00	
2491		.0000E 00	
2492		.0000E 00	
2493		.0000E 00	
2494		.0000E 00	
2495		.0000E 00	
2496		.0000E 00	
2497		.0000E 00	
2498		.0000E 00	
2499		.0000E 00	
2500		.0000E 00	
2501 PTIV (7)	DYNAMIC TORSION INIT. COND. DISPLACEMENTS	.0000E 00	
2502		.0000E 00	
2503		.0000E 00	
2504		.0000E 00	
2505		.0000E 00	
2506		.0000E 00	
2507		.0000E 00	
2508 PTID (7)	VELOCITIES	.0000E 00	
2509		.0000E 00	
2510		.0000E 00	
2511		.0000E 00	

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2512		.0000E 00	
2513		.0000E 00	
2514		.0000E 00	
2515 PTINDO (7)	ACCELERATIONS	.0000E 00	
2516		.0000E 00	
2517		.0000E 00	
2518		.0000E 00	
2519		.0000E 00	
2520		.0000E 00	
2521		.0000E 00	
2522 **OPEN** (9)			
2523			
2524			
2525			
2526			
2527			
2528			
2529			
2530			
2531 TMASS	TRANSMISSION MASS	.0000E 00	SLUG
2532 XCGT	TRANSMISSION CG LOCATION X	.0000E 00	
2533 YCGT	Y	.0000E 00	
2534 ZCGT	Z	.0000E 00	
2535 IXXI	TRANSMISSION MOM INERTIA ROLL	.0000E 00	SLUG-FT2
2536 IYYI	PITCH	.0000E 00	SLUG-FT2
2537 IZZI	YAW	.0000E 00	SLUG-FT2
2538 IXYI	R = P	.0000E 00	SLUG-FT2
2539 IXZI	R = Y	.0000E 00	SLUG-FT2
2540 IYZI	P = Y	.0000E 00	SLUG-FT2
2541 **OPEN** (14)			
2542			
2543			
2544			
2545			
2546			

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2547			
2548			
2549			
2550			
2551			
2552			
2553			
2554			
2555 1STALL	DYNAMIC STALL SIMULATION FLAG 1=STALL SIM.	.0000E 00	
2556 **OPEN** (3)			
2557			
2558			
2559 FACTM	FACTOR USED IN CM CALC DURING DYNAMIC STALL SIM.	.0000E 00	
2560 **OPEN**			
2561 PH1ZS	INIT. SHAFT PHI ROTATION	-.2000E 01	DEG
2562 TH1ZS	INIT. SHAFT THETA ROTATION	-.0000E 01	DEG
2563 PS1ZS	INIT. SHAFT PSI ROTATION	.0000E 00	DEG
2564 **OPEN** (6)			
2565			
2566			
2567			
2568			
2569			
2570 STA70	STATION WHERE SKEW AND DROOP BEGIN	.0000E 00	
2571 P1 (7)	DYNAMIC PITCH HORN INIT. COND. DISPLACEMENTS	.0000E 00	
2572		.0000E 00	
2573		.0000E 00	
2574		.0000E 00	
2575		.0000E 00	
2576		.0000E 00	
2577		.0000E 00	
2578 P1ND (7)	VELOCITIES	.0000E 00	
2579		.0000E 00	
2580		.0000E 00	
2581		.0000E 00	

ORIGINAL PAGE IS
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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2582		.0000E 00	
2583		.0000E 00	
2584		.0000E 00	
2585 PINDO (7)	ACCELERATIONS	.0000E 00	
2586		.0000E 00	
2587		.0000E 00	
2588		.0000E 00	
2589		.0000E 00	
2590		.0000E 00	
2591		.0000E 00	
2592 **NPE'*** (9)			
2593			
2594			
2595			
2596			
2597			
2598			
2599			
2600			
2601 ALFA (20)	AIRFRAME AERO COEFF TABLE ANGLE OF ATTACK	-.1800E 03	DEG
2602		.1800E 03	DEG
2603		.0000E 00	DEG
2604		.0000E 00	DEG
2605		.0000E 00	DEG
2606		.0000E 00	DEG
2607		.0000E 00	DEG
2608		.0000E 00	DEG
2609		.0000E 00	DEG
2610		.0000E 00	DEG
2611		.0000E 00	DEG
2612		.0000E 00	DEG
2613		.0000E 00	DEG
2614		.0000E 00	DEG
2615		.0000E 00	DEG
2616		.0000E 00	DEG
2617		.0000E 00	DEG
2618		.0000E 00	DEG
2619		.0000E 00	DEG
2620		.0000E 00	DEG
2621 CL (20)	AIRFRAME CL TABLE	.0000E 00	
2622		.0000E 00	
2623		.0000E 00	
2624		.0000E 00	
2625		.0000E 00	
2626		.0000E 00	

TABLE 1. - Continued

R/A	PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2627			.0000E 00	
2628			.0000E 00	
2629			.0000E 00	
2630			.0000E 00	
2631			.0000E 00	
2632			.0000E 00	
2633			.0000E 00	
2634			.0000E 00	
2635			.0000E 00	
2636			.0000E 00	
2637			.0000E 00	
2638			.0000E 00	
2639			.0000E 00	
2640			.0000E 00	
2641	CM	(20) AIRFRAME CM TABLE	.0000E 00	
2642			.0000E 00	
2643			.0000E 00	
2644			.0000E 00	
2645			.0000E 00	
2646			.0000E 00	
2647			.0000E 00	
2648			.0000E 00	
2649			.0000E 00	
2650			.0000E 00	
2651			.0000E 00	
2652			.0000E 00	
2653			.0000E 00	
2654			.0000E 00	
2655			.0000E 00	
2656			.0000E 00	
2657			.0000E 00	
2658			.0000E 00	
2659			.0000E 00	
2660			.0000E 00	
2661	CD	(20) AIRFRAME CD TABLE	.3650E 02	
2662			.3650E 02	
2663			.0000E 00	
2664			.0000E 00	
2665			.0000E 00	
2666			.0000E 00	
2667			.0000E 00	
2668			.0000E 00	
2669			.0000E 00	
2670			.0000E 00	
2671			.0000E 00	
2672			.0000E 00	
2673			.0000E 00	
2674			.0000E 00	

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TABLE 1. - Continued

R/A DESIGNATION SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2675		.0000E 00	
2676		.0000E 00	
2677		.0000E 00	
2678		.0000E 00	
2679		.0000E 00	
2680		.0000E 00	
2681 ANING	HING AREA	.1000E 01	FT2
2682 CHING	HING CHORD	.1000E 01	FT
2683 AUTN	TAIL ROTOR BLAD AREA	.1100E 02	FT2
2684 RTN	TAIL ROTOR RADIUS	.4670E 01	FT
2685 CLATH	TAIL ROTOR UCL/DALPHA	.5730E 01	
2686 R	TAIL ROTOR TIP LOSS FACTOR	.9700E 00	
2687 **OPEN**			
2688 CUTOUT	MAIN ROTOR BLADE AERO CUTOUT	.4500E 01	FT
2689 **OPEN** (112)			
2690			
2691			
2692			
2693			
2694			
2695			
2696			
2697			
2698			
2699			
2700			
2701			
2702			
2703			
2704			
2705			
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2712			
2713			
2714			
2715			

TABLE 1. - Continued

N/A	PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
	2716			
	2717			
	271A			
	2719			
	2720			
	2721			
	2722			
	2723			
	2724			
	2725			
	2726			
	2727			
	272A			
	2729			
	2730			
	2731			
	2732			
	2733			
	2734			
	2735			
	2736			
	2737			
	273A			
	2740			
	274C			
	2741			
	2742			
	2743			
	2744			
	2745			
	2746			
	2747			
	274A			
	2749			
	2750			
	2751			
	2752			
	2753			
	2754			
	2755			
	2756			
	2757			
	275A			
	2759			
	2760			
	2761			
	2762			
	2763			
	2764			
	2765			

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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2766			
2767			
2768			
2769			
2770			
2771			
2772			
2773			
2774			
2775			
2776			
2777			
2778			
2779			
2780			
2781			
2782			
2783			
2784			
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2789			
2790			
2791			
2792			
2793			
2794			
2795			
2796			
2797			
2798			
2799			
2800			
2A01 DPB (7)	PSEUDO PITCH HORN SAGE DATA DISPLACEMENTS	.0000E 00	
2802		.0000E 00	
2803		.0000E 00	
2804		.0000E 00	
2805		.0000E 00	
2806		.0000E 00	
2807		.0000E 00	
2A08 DPB (7)	VELOCITIES	.0000E 00	
2809		.0000E 00	
2810		.0000E 00	
2811		.0000E 00	
2812		.0000E 00	

TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2A13		.0000E 00	
2A14		.0000E 00	
2A15 OFF2 (7)	BACK VALUE PITCH HORN DISPLA EMENTS	.0000E 00	
2A16		.0000E 00	
2A17		.0000E 00	
2A18		.0000E 00	
2A19		.0000E 00	
2A20		.0000E 00	
2A21		.0000E 00	
2A22 ***OPEN** (9)			
2A23			
2A24			
2A25			
2A26			
2A27			
2A28			
2A29			
2A30			
2A31 SHFTC (36)	SHAFT DAMPING MATRIX (6,6) ARRAY	.0000E 00	
2A32		.0000E 00	
2A33		.0000E 00	
2A34		.0000E 00	
2A35		.0000E 00	
2A36		.0000E 00	
2A37		.0000E 00	
2A38		.0000E 00	
2A39		.0000E 00	
2A40		.0000E 00	
2A41		.0000E 00	
2A42		.0000E 00	
2A43		.0000E 00	
2A44		.0000E 00	
2A45		.0000E 00	
2A46		.0000E 00	
2A47		.0000E 00	
2A48		.0000E 00	
2A49		.0000E 00	
2A50		.0000E 00	
2A51		.0000E 00	
2A52		.0000E 00	
2A53		.0000E 00	
2A54		.0000E 00	
2A55		.0000E 00	
2A56		.0000E 00	
2A57		.0000E 00	

ORIGINAL PAGE IS
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TABLE 1. - Continued

R/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2858		.0000E 00	
2859		.0000E 00	
2860		.0000E 00	
2861		.0000E 00	
2862		.0000E 00	
2863		.0000E 00	
2864		.0000E 00	
2865		.0000E 00	
2866		.0000E 00	
2867 **OPEN** (4)			
2868			
2869			
2870			
2871 PPTOR (24)	DYNAMIC TENSION WIRE SHAPE	.0000E 00	
2872		.0000E 00	
2873		.0000E 00	
2874		.0000E 00	
2875		.0000E 00	
2876		.0000E 00	
2877		.0000E 00	
2878		.0000E 00	
2879		.0000E 00	
2880		.0000E 00	
2881		.0000E 00	
2882		.0000E 00	
2883		.0000E 00	
2884		.0000E 00	
2885		.0000E 00	
2886		.0000E 00	
2887		.0000E 00	
2888		.0000E 00	
2889		.0000E 00	
2890		.0000E 00	
2891 **OPEN** (4)			
2892			
2893			
2894			
2895			
2896			
2897			
2898			
2899 PFREH	PRINT FREQ. CONTROL CONSTANT	.5000E 01	
2900 NPP	NO. OF SIGNALS TO PRINT	.3100E 02	
2901 PP (48)	PRINT SIGNAL POINTER TABLE	.9700E 02	

TABLE 1. - Continued

N/A PROGRAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2902		.9800E 02	
2903		.9900E 02	
2904		.1000E 03	
2905		.3000E 01	
2906		.1010E 03	
2907		.6000E 01	
2908		.5000E 01	
2909		.1020E 03	
2910		.1030E 03	
2911		.1040E 03	
2912		.1050E 03	
2913		.1060E 03	
2914		.1070E 03	
2915		.1080E 03	
2916		.1090E 03	
2917		.1100E 03	
2918		.1110E 03	
2919		.1120E 03	
2920		.1130E 03	
2921		.1400E 02	
2922		.1300E 02	
2923		.1500E 02	
2924		.1140E 03	
2925		.1700E 02	
2926		.1600E 02	
2927		.1800E 02	
2928		.1900E 02	
2929		.1150E 03	
2930		.1160E 03	
2931		.1170E 03	
2932		.0000E 00	
2933		.0000E 00	
2934		.0000E 00	
2935		.0000E 00	
2936		.0000E 00	
2937		.0000E 00	
2938		.0000E 00	
2939		.0000E 00	
2940		.0000E 00	
2941		.0000E 00	
2942		.0000E 00	
2943		.0000E 00	
2944		.0000E 00	
2945		.0000E 00	
2946		.0000E 00	
2947		.0000E 00	
2948		.0000E 00	
2949	0000E 00 (52)		
2950			

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TABLE 1. - Concluded

R/A PHONGHAM SYMBOL	DESCRIPTION	SAMPLE VALUE	UNITS
2951			
2952			
2953			
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2961			
2962			
2963			
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2990			
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2994			
2995			
2996			
2997			
2998			
2999			
3000			
3000			

TABLE 2. - RELATIVE ADDRESS REVERSE DIRECTORY

I	ATP	1352	I	DFLO	32	I	GAINTH	88	I	KFLFS	1992	I
I	AKPH	1474	I	DFUCA	135	I	GAMMA	1268	I	KINTFS	1994	I
I	ALFA	2601	I	OGDMG	1263	I	GAMMA	63	I	KINFS	1993	I
I	ALPHA	54	I	DOEU	271	I	GASTUP	1276	I	KPFS	1990	I
I	AOTN	2683	I	DOEI	272	I	GKSTUP	1277	I	KPH	1447	I
I	AOING	2681	I	UPF	2401	I	GHEAG	1474	I	KPHCON	376	I
I	AITH	77	I	DPFD	2404	I	GRT	1473	I	KNUDFS	1988	I
I	H	2646	I	UPF2	2415	I	GRTM	1475	I	KTHCON	377	I
I	HET	34	I	UPTH	251	I	H	93	I	KTHFS	1989	I
I	HETA	1246	I	DMHDO	35	I	HMH	394	I	KTI	1345	I
I	HETAG	125	I	USOGJ	1361	I	HF	96	I	KTI	1346	I
I	HFAS	1270	I	USTAP	247	I	HMASS	346	I	KTHFC	1987	I
I	HI	541	I	UZFHH(1)	491	I	HP	1353	I	KXLF	1983	I
I	HLAUK	1241	I	UZFHH(2)	492	I	HSTG	2301	I	KYCF	1988	I
I	HMSM1 Y	761	I	UZFHH(3)	493	I	HPTH	741	I	KIPHM	503	I
I	HMSM1 YP	401	I	UZFHH(1)	495	I	HTH	1348	I	KPPHM	504	I
I	HMSM1 Z	741	I	UZFHH(2)	496	I	HVT	103	I	LAMTH	104	I
I	HMSM1 ZP	421	I	UZFHH(3)	497	I	HMAFLG	1257	I	LHT	101	I
I	HMSM2 Y	441	I	E	136	I	IMI	2	I	LMTU	111	I
I	HMSM2 YP	441	I	EINT	104	I	IM2	3	I	LVT	102	I
I	HMSM2 Z	441	I	ENDM22	92	I	IM3	4	I	MATGEN	31	I
I	HMSM2 ZP	401	I	EPHMPA	1484	I	IPHURN	1480	I	MATPRT	46	I
I	HMSM3 Y	921	I	ETAE	106	I	IPLUT	48	I	HAZ	51	I
I	HMSM3 YP	941	I	EUNT	94	I	IPRINT	49	I	QH	1	I
I	HMSM3 Z	941	I	ENMTU	95	I	IPUICH	47	I	NHP	5	I
I	HMSM3 ZP	941	I	FACTM	2554	I	ISTALL	2555	I	NC	37	I
I	HTIP	340	I	FHLV11,1	275	I	ISAP	45	I	NMSIG	2300	I
I	CD	2661	I	FHLV11,2	277	I	ISI	9	I	NMT	121	I
I	CDNTR	94	I	FHLV12,1	276	I	IS2	10	I	NHTU	122	I
I	CFH	1445	I	FHLV12,2	274	I	IS4	11	I	NMP	150	I
I	CFLY	1251	I	FHLV21,1	279	I	IS4	12	I	NPP	2900	I
I	CMT	114	I	FHLV21,2	281	I	ISS	13	I	NPT	6	I
I	CL	2621	I	FHLV22,1	240	I	IS6	14	I	NR	15	I
I	CLAG1	376	I	FHLV22,2	242	I	IXENG	1471	I	NRAD	494	I
I	CLAG2	371	I	FHLV31,1	243	I	IXRF	1461	I	NMFF	4	I
I	CLATR	2645	I	FHLV31,2	245	I	IXSP	341	I	NSAVE	43	I
I	CM	2641	I	FHLV32,1	244	I	IXXT	2535	I	NSIGNALS	1500	I
I	CONK	1253	I	FHLV32,2	246	I	IXYF	1464	I	NSP	7	I
I	CONH	110	I	FHLUC	124	I	IXYT	2534	I	NVAR	300	I
I	CPHUSP	378	I	FCF	114	I	IXZF	1465	I	NVEC	1801	I
I	CTHUSP	379	I	FCG	116	I	IXZT	2539	I	NVT	120	I
I	CTHIV	1250	I	FIDOLE	1444	I	IYVF	1462	I	OMEGR	52	I
I	CUTOUT	2648	I	FRTM	100	I	IYVT	2536	I	P REF I	324	I
I	CVF	1321	I	FLPTH	701	I	IYVTH	1472	I	PCDAN	303	I
I	CVK	1331	I	FMASS	91	I	IYZF	1466	I	PCDFL	390	I
I	CVP	1301	I	FND	441	I	IYZT	2540	I	PCLAN	304	I
I	CWING	2642	I	FUNCD	671	I	IZZF	1463	I	PCLFL	301	I
I	CYCFLG	134	I	FUNCP	1311	I	IZZM	1464	I	PCMAN	305	I
I	CZFHU	1252	I	FXHMT	1770	I	IZZSP	114	I	PCMFL	392	I
I	DAILO	33	I	FXHNU	1201	I	IZZT	2537	I	PU REF I	334	I
I	DMFAP	129	I	FXRA	1751	I	JETCYC	64	I	PDHFI	39	I
I	DMPTH	641	I	GAINAL	49	I	KAFRI	44	I	PDFLI	40	I
I	DCM	1246	I	GAINC	46	I	KALFS	1946	I	PDIMI	42	I
I	DELCD	1264	I	GATHEL	47	I	KOMFS	1991	I	PDIMI	41	I
I	DELZOM	1479	I	GAINRO	40	I	KELFS	1985	I	PDPT	57	I

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TABLE 2. - Concluded

I	PEHA	383	I	UNST 6	321	I	TAUVC	293	I	ZFHAH	378	I
I	PEHFL	381	I	UNSP1 1	304	I	TC(1)	287	I	ZGI	141	I
I	PEHFW	382	I	UNSP1 2	305	I	TC(2)	288	I	ZJUG	1482	I
I	PEHTEL	384	I	UNSP1 3	306	I	TC(3)	289	I	ZSPZ	1469	I
I	PEHTW	385	I	UNVW	67	I	TC(4)	290	I			I
I	PEHEU	2890	I	UNVW	73	I	TC(5)	291	I			I
I	PHIL	50	I	UNG21	137	I	TCI	1401	I			I
I	PHINEF	1209	I	UNG22	140	I	TCU1	36	I			I
I	PHIZS	2501	I	UNXCS	123	I	THFINO	34	I			I
I	PIH	66	I	UNYCS	124	I	THTAH	211	I			I
I	PIHND	72	I	UN	541	I	THTORS	2001	I			I
I	PIH	2571	I	US1 1	310	I	THIZS	2542	I			I
I	PIHND	2574	I	US1 2	311	I	THI	85	I			I
I	PIHND	2585	I	US1 3	312	I	THASS	2531	I			I
I	PIH	2901	I	US1 4	313	I	THML	127	I			I
I	PIHND	2871	I	US1 5	314	I	THWFLG	1497	I			I
I	PGENG	591	I	US1 6	315	I	THWA	126	I			I
I	PHEDW	592	I	USP1 1	301	I	THW	1488	I			I
I	PRCI	55	I	USP1 2	302	I	TPV(1)	145	I			I
I	PSOH	397	I	USP1 3	303	I	TPV(2)	146	I			I
I	PSITH	641	I	UN	41	I	TPV(3)	147	I			I
I	PSIZS	2563	I	UN REF 1	330	I	TSCLF	298	I			I
I	PSHWH	107	I	HATLXC	437	I	TSTUP	1496	I			I
I	PSVTH	386	I	HATLYC	438	I	TURULE	143	I			I
I	PT	151	I	HCTH	231	I	TURNSN	144	I			I
I	PTHUT	56	I	UN REF 1	336	I	TAS	294	I			I
I	PTIN	2501	I	UNW	109	I	UC	1001	I			I
I	PTIND	2506	I	UNF	115	I	UNSTOY	50	I			I
I	PTIND	2515	I	UNG	117	I	VI	62	I			I
I	PTIT	76	I	UNH	2644	I	WIMH	65	I			I
I	PTPI	1346	I	SASDAL	1462	I	WIMND	71	I			I
I	PTP2	1350	I	SASDEL	1455	I	WIPID	721	I			I
I	PTP3	1351	I	SASDND	1476	I	WITN	78	I			I
I	PVAL	346	I	SASDTH	1460	I	XCGT	2532	I			I
I	PACT	53	I	SASDA	1441	I	XCTB	171	I			I
I	PACT	74	I	SASDY	1446	I	XDDONE I	331	I			I
I	PVCT	54	I	SHAFIX	401	I	ZFHAH	372	I			I
I	PVPT	75	I	SHFIC	2831	I	Y	2141	I			I
I	UN REF 1	329	I	SUCC	1501	I	YCGT	2533	I			I
I	YCGZ	138	I	SIP	1354	I	YCTH	191	I			I
I	UN REF 1	335	I	SITH	98	I	YD	2162	I			I
I	UNST 1	322	I	SPVASS	139	I	YDD	2163	I			I
I	UNST 2	323	I	SR	1291	I	YDDONE I	332	I			I
I	UNST 3	324	I	STA70	2570	I	YDPI	439	I			I
I	UNST 4	325	I	STR	97	I	ZFHAH	373	I			I
I	UNST 5	326	I	SVEC	2491	I	ZJUG	1481	I			I
I	UNST 6	327	I	SR	501	I	ZHA	1441	I			I
I	UNSP1 1	307	I	SY	521	I	YP(1)	367	I			I
I	UNSP1 2	308	I	TAILOH	105	I	YP(2)	368	I			I
I	UNSP1 3	309	I	TAH	1267	I	YP(3)	369	I			I
I	UNST 1	316	I	TAHEL	388	I	YSC	1421	I			I
I	UNST 2	317	I	TAUG	595	I	YTH	274	I			I
I	UNST 3	318	I	TAUMT	369	I	ZAPM	1477	I			I
I	UNST 4	319	I	TAUMD	367	I	ZCGT	2534	I			I
I	UNST 5	320	I	TAUXC	292	I	ZDDONE I	333	I			I

3.4 Program Operation Via Input

The following is a narrative guide to the inputs listed in Section 3.3. The input data are discussed in logical groups which bring out the inter-relationship of the various inputs as well as giving details as to the nature of each input.

The program has two modes of operation: TRIM and FLY. In both cases the equations of motion are solved in the time domain. In TRIM the user specifies the flight condition by giving the trajectory velocity, the air density, the load factor, and other essential data. TRIM directly controls the main rotor collective, the main rotor cyclic input, the tail rotor collective, the fuselage angle of attack, and the bank angle (or whatever combination of trim variables are specified by the trim algorithm), and adjusts their value until the trim criteria are satisfied. The vehicle is usually understood to be trimmed when the mean value of the accelerations of the degrees of freedom approach zero. Vibratory components of 1P, 2P, etc., are allowed in all the degrees of freedom. TRIM can be conducted to any nonsteady flight condition, but the need has not arisen.

In FLY all the degrees of freedom selected are operative. Typically some of the degrees of freedom involving high-frequency modes are locked out, especially swashplate and dynamic torsion or dynamic pitch horn bending.

3.4.1 Case identification. - Case identification consists of a case I.D. and two title cards. The case I.D. and titles will appear on the printed output for identification. The case I.D., a title, and the date will appear on each frame of the graphic output. The case I.D. consists of up to 8 alphanumeric characters input beginning in column 9 of each CASE control card. Title character strings are input via a special 6000 series set of RA's, Table 3. Each character string is 60 characters beginning in column 11.

TABLE 3. - CASE IDENTIFICATION	
Input Quantity	Address
Title 1 Print Title #1	6001
Title 2 Print Title #2	6002
Title 3 Plot Title	6003
Title 4 (Not currently used)	6004

3.4.2 Case initialization

3.4.2.1 Integration and duration control. - Trajectory integration and duration are controlled by the input parameters in Table 4.

TABLE 4. - INTEGRATION AND DURATION CONTROL			
Input Quantity			Address
Ω_R	OMEGR	Initial main rotor speed, rad/sec	52
N_{az}	NAZ	No. of time points per revolution	51
	TCUT	Maximum number of revolutions to trim	36
	TSTOP	Flight stop time, sec	1498

The integration step size is determined indirectly by Ω_R and N_{az} .

$$\Delta t = \frac{2\pi}{(N_{az}) (\Omega_R)}$$

The total trajectory simulation time is the sum of trim time and fly time.

$$t_{total} = t_{trim} + t_{fly}$$

Trim can be bypassed by an input of TCUT = 0. If trim is to be activated; i.e., TCUT $\neq$ 0, then TCUT will serve as a backup to the trim convergence test. The maximum t_{trim} is then

$$t_{trim/max.} = N_{az} \cdot \Delta t \cdot TCUT$$

The time to fly, t_{fly} = TSTOP and can be zero if trim only is desired.

3.4.2.2 Atmospheric data. - The atmosphere model is minimal. A constant air density is assumed. Air data conditions required are given in Table 5.

TABLE 5. - AIR DATA CONDITIONS			
Input Quantity			Address
v_s	SS	speed of sound, m/s (ft/sec)	1291
ρ	RHO	atmosphere density, kg/m ³ (slugs/ft ³)	109
h	H	altitude, m (ft)	93

The altitude input is required to define a ground effect function. This function can be ignored by setting the altitude to some large value such as 1000 ft. An input of zero is not acceptable.

3.4.2.3 Trajectory orientation. - Trajectory and body orientation must be initialized. The required parameters are presented in Table 6. Earth azimuth, ψ_E , is assumed zero and not included in the problem. Pitch attitude, θ_E , will be computed in the program. See Figure 4 for reference.

TABLE 6. - TRAJECTORY ORIENTATION PARAMETERS			
Input Quantity			Address
V_T	VT	Trajectory velocity, m/s (knots)	62
β_F	BET	Sideslip angle, deg, + RT	38
α_F	ALPHA	Angle of attack, deg, + N UP	58
γ_F	GAMMA	Flight path angle, deg, + climb	63
ϕ_E	PHIE	Bank angle, deg, + RT	59

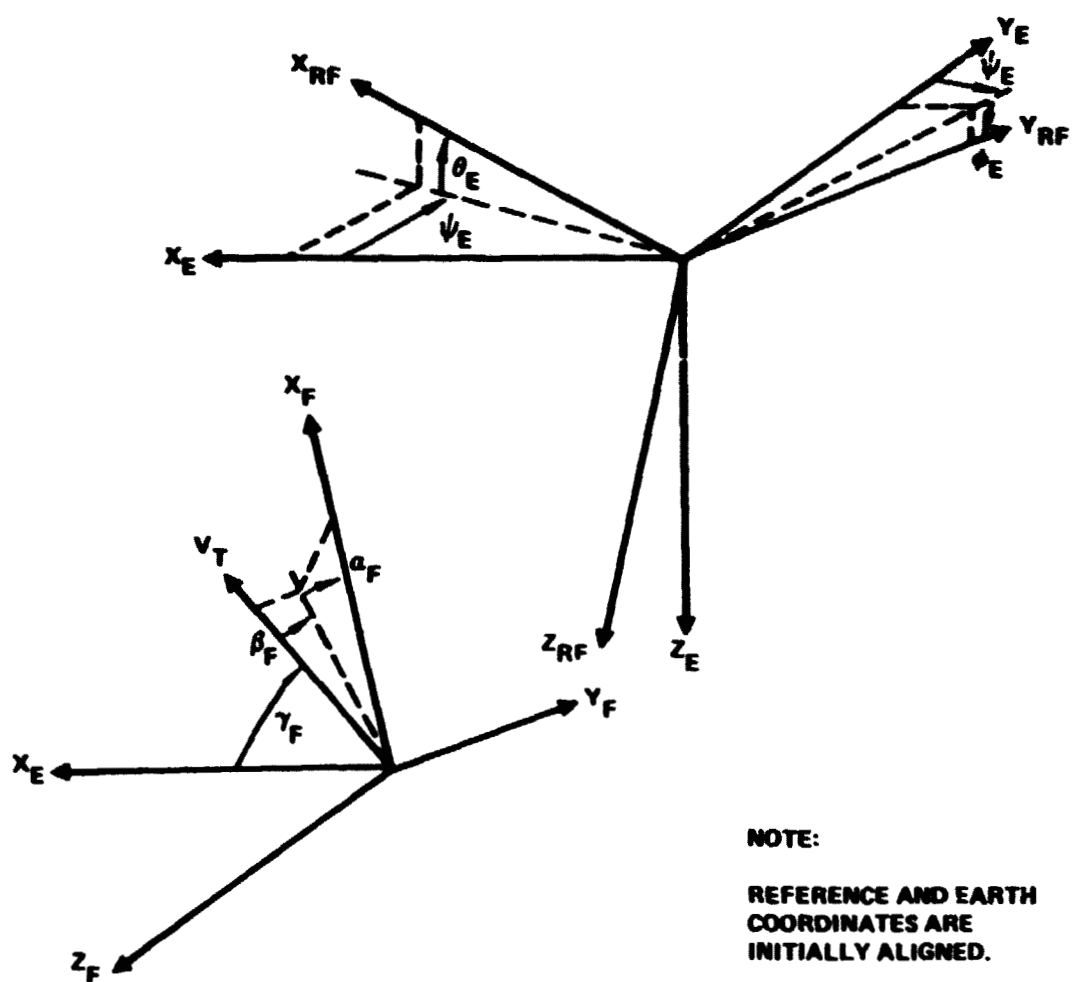


Figure 4. - Wind-earth-reference orientation.

Speed, V_T , and, sideslip angle, β_F , will remain fixed as input but may vary during the fly computation. The other angles either remain fixed, or are initial conditions for the trim iteration procedure which is covered in Section 3.4.3.

The fuselage velocity vector, and thus the reference vector are

$$v_f = V_T \sin \beta_F$$

$$u_f = (V_T^2 - v_f^2)^{1/2} \cos \alpha_F$$

$$w_f = (V_T^2 - v_f^2)^{1/2} \sin \alpha_F$$

The vehicle fuselage rates are determined by the following equations during trim:

$$p_f = -\dot{\psi}_E \sin \theta_E$$

$$q_f = \dot{\psi}_E \cos \theta_E \sin \theta_E$$

$$r_f = \dot{\psi}_E \cos \theta_E \cos \theta_E$$

where the yaw velocity is determined by the relation

$$\dot{\psi}_E = \frac{g}{V_T} K(n^2 - 1)^{1/2}$$

n and K are inputs (Table 7) and determine $\dot{\psi}_E$.

TABLE 7. - TURN INPUTS			
Input Quantity			Address
n	TURNLF	Turn load factor	143
K	TURNSEN	Turn direction indicator. +1, right; -1, left.	144

Normal inputs for the load factor and turn sign are

$$n = 1$$

and

$$K = 1,$$

giving unaccelerated flight.

3.4.2.4 System definition. - The generalized coordinate system is defined for each case by a small set of input indicators. These indicators and required relationships for program control are described below.

Generalized co-ord selection. - The elements of the generalized co-ord vector are determined by the user via input. The total system consists of subsystems which will be identified with some physical entity.

$$\{q\}_{NTOTL \times 1} = \begin{pmatrix} \{q_{BL}\} \\ \dots \\ \{q_{sp}\} \\ \dots \\ \{q_s\} \\ \dots \\ \{q_{REF}\} \\ \dots \\ \{q_R\} \end{pmatrix}$$

Each subsystem can be optionally included by proper identification at the subsystem level or in some cases, at the coordinate level, i.e., the selection of coordinates within a subsystem can be made. Required inputs and associated relationships are presented below.

Blade Subsystem

<u>Input</u>	<u>Quantity</u>	<u>Description</u>
NB	N_b	# of main rotor blades $0 \leq N_b \leq 7$
IM1		= 1 indicates presence of bending mode #1 = 0 indicates absence
IM2		Bending mode #2 indicator

<u>Input</u>	<u>Quantity</u>	<u>Description</u>
IM3		Bending Mode #3 indicator
NBP	N_{Bph}	Pitch horn bending indication (elastic feathering)
NPT	N_{ϕ_T}	Dynamic torsion indicator

Relationships

Total number of bending modes per blade, N_{m_b} .

$$NMB = IM1 + IM2 + IM3;$$

$$0 \leq NMB \leq 3$$

Total number of modes per blade, N_m .

$$NM = NMB + NMP + NPT$$

$$0 \leq NBP + NPT \leq 1 \text{ (mutually exclusive)}$$

$$0 \leq NM \leq 4$$

Total number of co-ord in the blade subsystem, N_{BS} .

$$NBS = NB \cdot NM$$

$$0 \leq N_{BS} \leq 28$$

Swashplate Subsystem $\{\phi, \theta, z\}_{SP}$

<u>Input</u>	<u>Quantity</u>	<u>Description</u>
NSP	N_{SP}	number of swashplate coordinates

Relationships

Special values identify specific subsets.

$$N_{SP} = 0 \rightarrow \text{no swashplate generalized coordinates}$$

$$N_{SP} = 1 \rightarrow \{q_{SP}\} = z_{SP}$$

$$N_{SP} = 2 \quad \{q_{SP}\} = \begin{Bmatrix} \phi \\ \theta \end{Bmatrix}_{SP}$$

$$N_{SP} = 3 \quad \{q_{SP}\} = \begin{Bmatrix} \phi \\ \theta \\ z \end{Bmatrix}_{SP}$$

$$0 \leq N_{SP} \leq 3$$

Reference Subsystem

Input

NREF N_{REF} number of reference coordinates

$$N_{REF} = 0, 6$$

$$\{q_{REF}\} = \{x, y, z, \phi, \theta, \psi\}_{REF}$$

Shaft Subsystem

All 6 shaft coordinates, $\{x, y, z, \phi, \theta, \psi\}_S$ are independently selectable.

<u>Input</u>	<u>Quantity</u>	<u>Description</u>
IS1	x_S	shaft degrees of freedom
IS2	y_S	
IS3	z_S	
IS4	ϕ_S	
IS5	θ_S	
IS6	ψ_S	

A value of 0 means exclude

A value of 1 means include

Relationships

Total number of shaft coordinates, N_S :

$$N_S = IS1 + IS2 + IS3 + IS4 + IS5 + IS6$$

$$0 \leq N_S \leq 6$$

Rotor Subsystem $\{W\}_R$

<u>Input</u>	<u>Quantity</u>	<u>Description</u>
NR	N_R	number of rotor coordinates; $0 \leq N_R \leq 1$

Total number of generalized coordinates, N_{TOTL}

$$N_{TOTL} = N_{BS} + N_{SP} + N_S + N_{REF} + N_R$$

$$0 \leq N_{TOTL} \leq 44$$

Subsystem vector locations within generalized vector are

$$L_{BS} \quad L_{BS} = 1$$

$$L_{SP} \quad L_{SP} = L_{BS} + N_{BS}$$

$$L_S \quad L_S = L_{SP} + N_{SP}$$

$$L_{REF} \quad L_{REF} = L_S + N_S$$

$$L_R \quad L_R = L_{REF} + N_{REF}$$

The required inputs are summarized in Table 8.

TABLE 8. - DEGREE OF FREEDOM FLAGS		
Input Quantity		Address
NB	Number of rotor blades	1
IM1	Blade mode enable flags, = 1. on, = 0. off	2
IM2		3
IM3		4
NBP	Pitch horn bending flag	5
NPT	Blade torsion flag	6
NSP	Swashplate motion selector	7
IS1	Shaft bending mode select flags; = 1. on, = 0. off	9
IS2		10
IS3		11
IS4		12
IS5		13
IS6		14
NR	Rotor speed variable flag; = 1. on, = 0. off (except for differential from PSITB, RA (641-661))	15
NREF	Reference axes set select; = 6. on, = 0. off	8

3.4.2.5 Subsystem initialization. - The reference set initial conditions are summarized in Table 9. Normally only the acceleration due to gravity RA(333) = -32.174 (conventional units) need be entered. The rate information is somewhat superfluous, however, these RA locations are part of a trim save and restart procedure, and are, therefore, listed for completeness.

Initial conditions for the shaft and swashplate generalized coordinates, velocities and accelerations are listed in Table 10. If these degrees of freedom are to be used, estimates of deflections should be entered to minimize startup transients. Similar inputs for blade modes and blade rotary mount representations are also included in this table. Normally only the deflection modal data are input. Again, the RA locations are part of the trim save and restart, therefore, the time derivatives are also listed.

TABLE 9. - INITIAL REFERENCE SET DATA

Input Quantity		Address
PRF	Initial reference roll rate, rad/sec	328
QRF	Initial reference pitch rate, rad/sec	329
RRF	Initial reference yaw rate, rad/sec	330
PDRF	Initial reference roll acceleration, rad/sec ²	334
QDRF	Initial reference pitch acceleration, rad/sec ²	335
RDRF	Initial reference yaw acceleration, rad/sec ²	336
XDDORF	Initial longitudinal reference acceleration, m/s ² (ft/sec ²), (+) fwd	331
YDDORF	Initial lateral reference acceleration, m/s ² (ft/sec ²), (+) right	332
ZDDORF	Initial vertical reference acceleration, m/s ² (ft/sec ²), (+) down	333

TABLE 10. - SWASHPLATE, SHAFT AND BLADE INITIAL CONDITIONS

Input Quantity		Address
QSPI(3)	Swashplate ϕ , θ , z initial conditions	301-303
QDSPI(3)	Swashplate rate initial conditions	304-306
QDDSPI(3)	Swashplate acceleration initial conditions	307-309
QSI(6)	Shaft initial conditions, $(XYZ\phi\theta\psi)_S$	310-315
QDSI(6)	Shaft rate initial conditions	316-321
QDDSI(6)	Shaft acceleration initial conditions	322-327
Y(3,7)*	Blade bending mode shape initial conditions	2141-2161
YD(3,7)	Blade bending mode shape velocity initial conditions	2162-2182

*The first index is the mode number. The second index is the blade number.

TABLE 10. - Concluded		
Input Quantity		Address
YDD(3,7)	Blade bending mode shape acceleration initial conditions	2183-2203
PTIN(7)	Dynamic torsion initial deflection, rad	2501-2507
PTIND(7)	Dynamic torsion initial rate, rad/sec	2508-2514
PTINDD(7)	Dynamic torsion initial acceleration, rad/sec ²	2515-2521
PIN(7)	Dynamic pitch horn bending, rad	2571-2577
PIND(7)	Dynamic pitch horn bending rate, rad/sec	2578-2584
PINDD(7)	Dynamic pitch horn bending acceleration, rad/sec ²	2585-2591
DPF(7)	Quasi-steady pitch horn bending, rad	2801-2807
DPFD(7)	Quasi-steady pitch horn bending rate, rad/sec	2808-2814
DPF2(7)	Back valve quasi steady pitch horn bending, rad	2815-2821
THTORS(20,7)	Quasi steady torsion initial spanwise distribution per blade, rad	2001-2140

3.4.2.6 Control initialization. - The pilot input controls may also be initialized to reduce start transients and shorten trim time. These inputs are given in Table 11. The units of the listed quantities is a function of the control scaling factors given in Section 3.4.14. Normally the control inputs will be in percent of full throw, but actual deflections such as feet, centimeters, degrees, etc., can be used.

TABLE 11. - CONTROL INITIALIZATION		
Input Quantity		Address
PXCT	Longitudinal cyclic stick input, (+) aft	53
PYCT	Lateral cyclic stick input, (+) right	54
PRCT	Rudder pedals (+) right forward	55
PTHOT	Collective, (+) up	56
PDPT	Thrustor power lever, (+) increase RPM	57
PDDBI	Dive brake setting, (+) extend	39
PDFLI	Flap setting, (+) extend	40
PDIWI	Wing incidence setting, (+) nose up from airframe aero data reference setting	41
PDIHI	Lower horizontal tail incidence setting, (+) nose up from aero data reference setting	42

3.4.2.7 Inflow/downwash initialization. - Main rotor downwash functions may be input to begin calculations under favorable conditions. These values are calculated using differential equations. Therefore time derivatives are also input. Note WIMR is a divisor to the program, and as such a nonzero entry must be provided. An initial tail rotor downwash can also be input. These inputs are summarized in Table 12.

The tail rotor downwash and flap angle functions are modeled in REXOR II with lag equations of the form

$$w^{n+1} = e^{-dt/\tau} w^n + (1 - e^{-dt/\tau}) f(w^n)$$

These equations require time constant, τ .

The lag equation time constants are required for both physical realism and program numerical stability. See Table 13.

TABLE 12. - INFLOW DATA		
Input Quantity		Address
WIMR	Vertical downwash +DN	65
PIMR	Roll downwash +RT	66
QIMR	Pitch downwash +N UP	67
WITR	Tail rotor downwash	78
WIMRD	Vertical downwash time derivative	71
PIMRD	Roll downwash time derivative	72
QIMRD	Pitch downwash time derivative	73

TABLE 13. - TIME LAG CONSTANTS		
Input Quantity		Address
TC(1)	τ for downwash functions during trim	267
TC(2)	τ for downwash functions during fly	268
TC(3)	τ for tail rotor flap angle function	269

3.4.3 Trim algorithm. - The trimming process in REXOR II establishes a set of initialized data for the equations of motion prior to entering the free flight, maneuvering input phase of the program known as FLY. Some groups of degrees of freedom operate the same in TRIM or FLY. They, in effect, seek their own equilibrium state during the trimming phase of operation. Active blade, swashplate, and shaft degrees of freedom comprise this category.

The remaining initialization values, are controlled by a set of temporary servo loop closures which form a specialized autopilot during TRIM.

The following operations occur during TRIM.

1. The flight path (velocity data) is preset as a function of user input. Integrated flight path acceleration information is not used.
2. An array of signals (acceleration, moments, forces, etc.) selected by the user is measured against a set of target values (also user input) to determine a set of error signals.
3. A set of physical controls and/or model parameters, selected by the user, are varied according to coupling gains from the error signals of Step 2. A one to one relation exists between the elements of 2, the coupling gains (user input) and the elements of 3.
4. Trimming continues until all the elements of Step 3 are simultaneously within an activity band set of tolerances determined by the user.

The conditions forming Step 1 are described in Section 3.4.2. The information groups required by Step 2 through 4 are summarized in Table 14.

TABLE 14. - TRIM ALGORITHM SELECTION		
Input Quantity		Address
NC	Number of variables to be controlled in Trimming	37
CVP(10)	Identifier list of controls and variables to be moved to achieve trim.	1301-1310
FUNCP(10)	Identifier list of quantities to be used as trim error signals listed in order of pairing with CVP candidates	1311-1320
CVE(10)	Trim convergence tolerance test limits of CVP candidates from one rotor cycle to next. Listed in order defined by CVP.	1321-1330

TABLE 14. - Concluded		
Input Quantity		Address
CVK(10)	Loop gains for pairing of FUNCP signals operating on CVP candidates.	1331-1340
FUNCD(10)	Zero trim error levels of candidate signals, FUNCP. (Usually zero)	671-680

Simply stated, trim is a state of system equilibrium. The function of the trim segment of the program is to reach that state. Pilot controls, vehicle attitude, and other system unknowns are determined such that starting boundary conditions are met by the equations of motion using a repeating solution. The appropriate values of the problem unknown are determined iteratively by an algorithm of the form

$$x_{n+1} = x_n - f_n(g)K\Delta t$$

$$f_n(g) = e^{-\Delta t/\tau} f_{n-1}(g) + g$$

where the subscript n denotes the nth computation point. Assuming a functional relationship between g and X, the above control relationship can be used to determine the value of X such that g = 0 or other desired final value. Within REXOR II it has not been found necessary to consider the controls and accelerations as a system. Independent relationships are assumed. Trim signals thus can be matched one to one with a control input. For example, vertical acceleration can be controlled by main rotor collective. Before proceeding, notice that there are two parameters in the control equation, namely τ and K, which can be used to control convergence. The K's are input parameters to REXOR II. Experience has shown that tau, τ , should be set such that the ratio $\Delta t/\tau$ remains a constant and near a value of 0.3. This ratio is internally set in the program. K is considered a gain factor and particular to the variables involved.

The array CVP(10) controls the selection of trim controls and variables. The available list of candidates is given in Table 15. Note that in REXOR II there is no preset grouping of controlled and controlling variables.

Usually 6 variables are controlled in trim, and this number is set in NC. Then a like number of candidates must be selected from Table 15 and entered in the CVP array. This array must be thought out so that it does not over-specify (over determine) or under specify a trim state contemplated. Also mutually contradictory selections are to be guarded against.

TABLE 15. - TRIM CONTROL CANDIDATES
(For Use in CVP and FUNCP Vectors)

Value	=1.	Fuselage linear forward acceleration, $\dot{u}_F$
	=2.	Fuselage linear lateral acceleration, $\dot{v}_F$
	=3.	Fuselage linear vertical acceleration, $\dot{w}_F$
	=4.	Fuselage roll acceleration, $\dot{p}_F$
	=5.	Fuselage pitch acceleration, $\dot{q}_F$
	=6.	Fuselage yaw acceleration, $\dot{r}_F$
	=7.	Fuselage roll earth attitude, ϕ_E
	=8.	Longitudinal cyclic stick input, % $X_{c,T}$
	=9.	Lateral cyclic stick input, % $Y_{c,T}$
	=10.	Rudder pedals input, % $r_{c,T}$
	=11.	Collective input, % $\theta_{o,T}$
	=12.	Thrust power lever setting, % $S_{p,T}$
	=13.	Fuselage angle of attack, α_F
	=14.	Fuselage climb angle, γ_F
	=15.	Rotor drive engine torque, ENDMZZ
	=16.	Rotor speed acceleration, $\ddot{\psi}_R$
	=17.	Rotor torque, F_{ψ_R}
	=18.	Hub lateral moment, M_{ϕ_H}
	=19.	Hub longitudinal moment, M_{θ_H}
	=20.	Rotor lift, F_{Z_H}

Next the list of trim error signals FUNCP is considered. Again note that the CVP and FUNCP (as well as the other vectors of Table 14) must hold a one to one ordering. Table 15 also lists the signals for this use.

Usually the trim end values associated with these FUNCP selections are zero. These are entered in the FUNCD array. However in the case of moments and lift, a nonzero entry will most likely be called for.

The selection of trim gains for the CVK array is by in large an open subject. Experience and similar, successful cases are the best guide. A trim gain too high causes a convergence failure, a value too low wastes computer time.

The usual procedure is to make a guesstimate of the value based on past experience and observe the trim time-history plot. The gain can be increased on slow-to-trim variables, and decreased on those that appear to be oscillating or following the vibratory component of the accelerations as well as the mean.

The trim loop has a built in negative feedback sign. Thus if a plus CVP quantity response is correct for a plus going FUNCP quantity, then the corresponding CVK quantity should be minus.

Trim convergence is controlled by a set of simple convergence tests, all of which must be simultaneously satisfied. Movement of the controls, CVP vector, (quiescence) is monitored rather than relative zero tests on the accelerations. Control parameters are compared after every revolution.

The convergence numbers are set in the CVE vector. No hard and fast rules exist as to what constitutes a good or a bad trim. A starting guide is given in Table 16. Note that the cyclic convergence is given in terms of fixed units quantity, namely blade angle. The conversion to stick input tolerances (user input) is a function of the control scaling inputs (described in Section 3.4.14). Likewise horizontal acceleration and/or thrust control settings can be derived from the fuselage longitudinal force tolerance number.

TABLE 16. - TRIM CONVERGENCE GUIDE
(Prime denotes value one revolution from unprimed value)

$$|F'_{X_H} - F_{X_H}| < 10.$$

$$|\beta'_p - \beta_p| < 0.001$$

$$|A'_{1S} - A_{1S}| < 0.001$$

$$|B'_{1S} - B_{1S}| < 0.001$$

$$|\theta'_0 - \theta_0| < 0.001$$

TABLE 16. - Concluded

$$|\theta'_{TR} - \theta_{TR}| < 0.001$$

$$|\phi'_E - \phi_E| < 0.01$$

$$|y'_F - y_F| < 0.01$$

$$|\alpha'_F - \alpha_F| < Q \text{ where } Q = 0.01 \text{ for autorotation}$$

$$Q = 0.001 \text{ otherwise}$$

Effort and computer time can be reduced for repeated or similar cases by the use of an option known as trim save. The activation of IPUNCH = RA(47) causes trim cards to be punched with values at the end of a successful trim. These trim cards in RA format may be used to initialize a case at similar conditions. They should be used with care to be sure the desired flight conditions are not being overridden by these trim save cards.

Table 17 gives all of the addresses which will be punched if IPUNCH = 1.

TABLE 17. - TRIM SAVE CARDS

Quantity		Address
PACT		53
PYCT		54
PRCT		55
PTHOT		56
PDPT		57
ALPHA	}	58
PHIE		59
GAMMA		63
WIMR		65
PIMR		66
QIMR		67
WIMRD		71
PIMRD		72
QIMRD		73
AITR	CONVERTED TO DEGREES	77
WITR		78
H		93
ENDMZZ		92
QSPI(3)		301-302
QDCTI(3)		304-306
QDDSPI(3)		307-309
QSI(6)		310-315
QDSI(6)		316-321
QDDSPI(6)		322-327
WRFI(3)	(p, q, r)REF	328-330
ARFI(3)	(x, y, z)REF	331-336
CZERO		1252
THTORS(20, 7)		2001-2140
Y(3, 7)		2141-2161
YD(3, 7)		2162-2182
YDD(3, 7)		2183-2203
PTIN(7)		2501-2507
PTIND(7)		2508-2514
PTINDD(7)		2515-2521
PIN(7)		2571-2577
PIND(7)		2578-2584
PINDD(7)		2585-2591
DPF(7)		2801-2807
DPFD(7)		2808-2814
DPF2(7)		2815-2821

3.4.4 Flight simulation control. - Upon the successful completion of TRIM, or reaching TCUT revolutions, the FLY mode may be entered. During the FLY mode, the complete system of equations, as defined by the user, is integrated for a specified period of equivalent real time. A variety of control inputs may be exercised, and are discussed below.

A pilot can be simulated with a time history of control displacements as inputs. The displacements can be those for a step, a pulse, etc., or the actual time history of the control displacements from flight tests. This input is only the incremental maneuvering input over and above that required for trim. The pilot controls are lateral and longitudinal stick position, main rotor collective angle, rudder pedals, thrust or setting, and rotor speed. The rotor speed input is operative only when the rotor speed degree of freedom is off. The vertical swashplate degree of freedom changes the pilot's collective setting at the rotor, and a tail rotor damper changes the actual tail rotor collective from the pilot command. The pilot control commands are input to the program in tabular form as a function of time. One table of time values is used in connection with all command tables. Additional control inputs are provided for dive brake and flap extension as well as wing and lower horizontal tail incidence change.

To illustrate the procedure consider Figure 5. Assume the desired data points for three functions, y_1 , y_2 , and y_3 are denoted by the circles. Each function is individually projected onto the time axis. Then the total set of time points is reprojected onto each function as Δ 's. The resultant time table will be the total set of time points and values at the Δ 's as well as the 0's. All functions are linearly interpolated. Functions are evaluated as constant for times beyond the last time point, i.e., no extrapolation. A step function must be approximated with a ramp. More specifically, the table times must adhere to the relation

$$t_n - t_{n-1} > dt$$

where dt is the integration step size. If the second time table value is zero, then the program assumes no pilot inputs. The tables are restricted to 20 points. The number of points used is required as an input. The controls and addresses are given in Table 18.

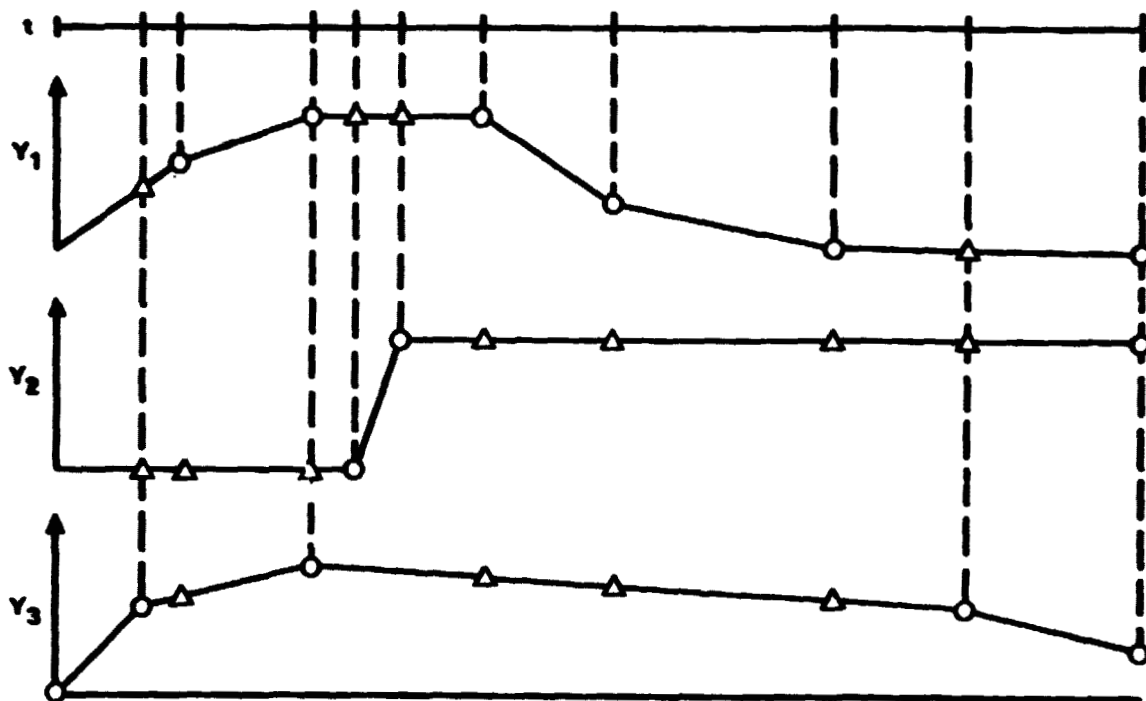


Figure 5. - Pilot command data.

In the equations that follow, the value of a function resulting from a pilot table lookup will be subscripted with a (P). The trimmed value of a control will be denoted with a subscript (T).

The resultant main rotor collective is not only a function of pilot maneuvering and trim, but also swashplate motion.

$$\theta_0 = \theta_{0,T} + \theta_{0,P} - (Z_{SP} - Z_{SP,T})/e$$

where e is the pitch horn arm. Note that Z_{gp} and $Z_{SP,T}$ are made equal at the end of trim.

If the rotor degree of freedom is not active, then a variable rotor speed can be simulated by inputting a differential speed in PSITB(20) as described above, resulting in the equation

$$\dot{\psi}_R = \Delta\dot{\psi}_{R,P} + \Omega_R$$

TABLE 18. - CONTROL INPUTS

Input Quantity		Address
NMF	Number of points in control tables	150
PT(20)	Pilot time table, sec	151-170
XCTB	Pilot longitudinal stick displacement (+) aft	171-190
YCTB	Pilot lateral stick displacement (+) right	191-210
THTAB(20)	Pilot collective input (+) thrust	211-230
RCTB(20)	Pilot rudder pedal input (+) right pedal forward	231-250
DPTB(20)	Pilot thruster input (+) thrust	251-270
PSITB(20)	Pilot engine speed, rad/sec differential from nominal	641-660
FLPTB	Flap extension, (+) down	701-720
WIPTB	Wing incidence change, (+) nose up	721-740
HIPTB	Lower horizontal tail incidence change, (+) nose up	741-760
DBPTB	Dive brake extension, (+) outward	681-700

where

$$\Omega_R = RA(52)$$

Note that other than time and speed no units are given in the above table. This is because the input scaling factor selection Section 3.4.14 determines these units. Generally factors are selected so that pilot input data are in percent of full control travel. However scaling can be set to give conventional or SI control input functions.

3.4.5 Output options. - The user of REXOR II has in his control via input the definition and presentation option of signals generated by the program. Signal output includes printed time histories of selected signals, and graphic (CALCOMP) presentation of selected signals. Specified signals can also be harmonically analyzed. These options are discussed in paragraphs 3.4.5.1 through 3.4.5.4. A modest amount of diagnostic print can also be activated. These capabilities are expanded in paragraph 3.4.5.5. Two useful data utility functions are also available. See paragraph 3.4.5.6.

3.4.5.1 Output signal definition. - The data output philosophy of REXOR II is based on a signal generator-signal recorder concept. REXOR II generates signals which are sampled and recorded with a time reference, for later use.

The user has complete control of the definition of the signal set via the inputs presented in Table 19. Up to 200 signals can be drawn from unlabeled COMMON within the program. There are 3000 quantities defined in unlabeled COMMON. Unlabeled COMMON is enumerated in Table 20.

TABLE 19. - SIGNAL SELECTION CONTROL		
Input Quantity		Address
NSIG	Number of signals to be recorded (up to 200).	1500
SLOC	List of selected output signals identified by list number from unlabeled COMMON table.	1501-1700
UC	Table of output signal conversion factors. Matches SLOC items in same order. Zero default assumes unity factor.	1001-1200
NSAVE	Number of integration steps per data sample. Default gives approx. 19 samples per main rotor revolution.	43
PLAB	Signal label table. 20 character maximum per signal label.	5001-5200

TABLE 20. - OUTPUT SIGNAL SELECTION LIST
(Unlabeled COMMON)

Location	Program Symbol	Description
1	TIME	Total trajectory time
2	DT	Integration step
3-52	GC(50)	Generalized coordinates
53-102	GCD(50)	Generalized velocities
103-152	GCDD(50)	Generalized accelerations
153-182	AUXE(30)	Auxiliary integrator output vector where
153		ϕ_E
154		θ_E
155		ψ_E
156		U_{REF}
157		V_{REF}
158		W_{REF}
159		Lag integrator
160		Washout integrator
161-170		SAS channels 2-6
171		X_{CS}
172		Y_{CS}
173		X_E
174		Y_E
175		Z_E
176-182		Elements not defined

TABLE 20. - Continued		
Location	Program Symbol	Description
183-212	AUXD(3C)	Auxiliary Integrator input vector where
183		$\dot{\phi}_E$
184		$\dot{\theta}_E$
185		$\dot{\psi}_E$
186		$\dot{U}_{REF}$
187		$\dot{V}_{REF}$
188		$\dot{W}_{REF}$
189-200		SAS function inputs
201-202		Cyclic stick filter inputs
203		$\dot{X}_E$
204		$\dot{Y}_E$
205		$\dot{Z}_E$
206-212		Elements not defined
213-233	A(3,7)	Blade modal deflection matrix where
213		Mode 1 - blade 1 deflection
214		Mode 2 - blade 1 deflection
215		Mode 3 - blade 1 deflection
216-218		Blade 2 deflections
219-221		Blade 3 deflections
222-224		Blade 4 deflections
225-227		Blade 5 deflections

TABLE 20. - Continued)

Location	Program Symbol	Description
228-230	AD(3,7)	Mode 3 - Blade 6 deflections
231-233		Blade 7 deflections
234-254		Blade modal velocity matrix
		where
234		Mode 1 - blade 1 velocity
235		Mode 2 - blade 1 velocity
236		Mode 3 - blade 1 velocity
237-239		Blade 2 velocities
240-242		Blade 3 velocities
243-245		Blade 4 velocities
246-248		Blade 5 velocities
249-251		Blade 6 velocities
252-254		Blade 7 velocities
255-275		Blade modal acceleration matrix
		where
255		Mode 1 - blade 1 acceleration
256		Mode 2 - blade 1 acceleration
257		Mode 3 - blade 1 acceleration
258-260	ADD(3,7)	Blade 2 accelerations
261-263		Blade 3 accelerations
264-266		Blade 4 accelerations
267-269		Blade 5 accelerations

TABLE 20. - Continued

Location	Program Symbol	Description
270-272		Mode 3 - Blade 6 accelerations
273-275		Blade 7 accelerations
276-282	P(7)	Dynamic pitch horn bending mode, blades 1-7
283-289	PD(7)	Dynamic pitch horn bending rate, blades 1-7
290-296	PDD(7)	Dynamic pitch horn bending accel., blades 1-7
297-303	PT(7)	Dynamic torsion mode, blades 1-7
304-310	PDT(7)	Dynamic torsion rate, blades 1-7
311-317	PDDT(7)	Dynamic torsion acceleration, blades 1-7
318	PSIR	ψ_R Rotor coordinate
319	PSIDR	$\dot{\psi}_R$
320	PSIDDR	$\ddot{\psi}_R$
321	PHSP	ϕ_{SP}
322	THSP	θ_{SP}
323	ZSP	z_{SP}
324	PHDSP	$\dot{\phi}_{SP}$
325	THDSP	$\dot{\theta}_{SP}$
326	ZDSP	$\dot{z}_{SP}$
327	PHDDSP	$\ddot{\phi}_{SP}$
328	THDDSP	$\ddot{\theta}_{SP}$
329	ZDDSP	$\ddot{z}_{SP}$
330-335	DISPS(6)	Shaft displacement vector, $(x \ y \ z \ \phi \ \theta \ \psi)_S$
336-341	VELS(6)	Shaft velocity vector, $(\dot{x} \ \dot{y} \ \dot{z} \ \dot{\phi} \ \dot{\theta} \ \dot{\psi})_S$
342-347	ACCS(6)	Shaft acceleration vector, $(\ddot{x} \ \ddot{y} \ \ddot{z} \ \ddot{\phi} \ \ddot{\theta} \ \ddot{\psi})_S$

TABLE 20. - Continued

Location	Program Symbol	Description
348-353	DISRF(6)	Ref. displacement vector, $(x\ y\ z\ \phi\ \theta\ \psi)_{RF}$
354-359	VELRF(6)	Ref. velocity vector, $(\dot{x}\ \dot{y}\ \dot{z}\ \dot{\phi}\ \dot{\theta}\ \dot{\psi})_{RF}$
360-365	ACCRF(6)	Ref. acceleration vector, $(\ddot{x}\ \ddot{y}\ \ddot{z}\ \ddot{\phi}\ \ddot{\theta}\ \ddot{\psi})_{RF}$
366-368	VHUB(3)	Hub linear velocity, $(u\ v\ w)_H$
369-371	VDHUB(3)	Hub linear acceleration, $(\dot{u}\ \dot{v}\ \dot{w})_H$
372-374	WHUB(3)	Hub angular velocity, $(p\ q\ r)_H$
375-377	WDHUB(3)	Hub angular acceleration, $(\dot{p}\ \dot{q}\ \dot{r})_H$
378-380	VFUS(3)	Fuselage linear velocity, $(u\ v\ w)_F$
381-383	VDFUS(3)	Fuselage linear acceleration, $(\dot{u}\ \dot{v}\ \dot{w})_F$
384-386	WFUS(3)	Fuselage angular velocity, $(p\ q\ r)_F$
387-389	WDFUS(3)	Fuselage angular acceleration, $(\dot{p}\ \dot{q}\ \dot{r})_F$
390-392	WSP(3)	Swashplate angular velocity, $(p\ q\ r)_{SP}$
393-395	WDSP(3)	Swashplate angular acceleration, $(\dot{p}\ \dot{q}\ \dot{r})_{SP}$
396-398	VR(3)	Rotor linear velocity, $(u\ v\ w)_R$
399-401	VDR(3)	Rotor linear acceleration, $(\dot{u}\ \dot{v}\ \dot{w})_R$
402-404	WR(3)	Rotor angular velocity, $(p\ q\ r)_R$
405-407	WDR(3)	Rotor angular acceleration, $(\dot{p}\ \dot{q}\ \dot{r})_R$
408-410	DMH(3)	Location of hub relative to transmission mount
411-413	GRAVR(3)	Gravity vector in rotor coordinates

TABLE 20. - Continued)

Location	Program Symbol	Description
414-875	F(65,7)	Main rotor blade force and mass integral matrix. Refer to Vol II, SWEEP1 routine for detailed definitions. Blade subsets are
414-479		Blade 1 functions
480-545		Blade 2 functions
546-611		Blade 3 functions
612-677		Blade 4 functions
678-743		Blade 5 functions
744-809		Blade 6 functions
810-875		Blade 7 functions
876-882	PHF(7)	Feather angle, ϕ_F , for blades 1-7
883-889	TFA(7)	Feathering moment, M_{FA} , blades 1-7
890-939	DELF(50)	Generalized force vector, ΔF
940-945	QLOADS(6)	Total non-rotating aerodynamic loads
946-957	FR(12)	Total rotor loads in rotating coordinates, FR(1) - FR(6); and FR(7)-FR(12) are aerodynamic loads only.
958-969	FF(12)	Total rotor loads in non-rotating coordinates, FF(1)-FF(6); and FF(7)-FF(12) are aerodynamic loads only.
970-975	FN(6)	Fixed surface aerodynamic loads in fuselage axes
976-981	FNW(6)	Fixed surface aerodynamic loads in wind axes
982-987	FTR(6)	Tail rotor aerodynamic loads
988-993	FP(6)	Thrustor loads

TABLE 20. - Continued)

Location	Program Symbol	Description
994-1133	XSV(20,7)	X-shear center deflection for each blade station and blade
		where
994-1013		Blade 1 X-locations
1014-1033		Blade 2 X-locations
1034-1053		Blade 3 X-locations
1054-1073		Blade 4 X-locations
1074-1093		Blade 5 X-locations
1094-1013		Blade 6 X-locations
1014-1033		Blade 7 X-locations
1034-1273	YSV(20,7)	Y-shear center deflection for each blade station and blade
1274-1413	ZSV(20,7)	Z-shear center deflection for each blade station and blade
1414-1553	YPS(20,7)	Chordwise slope at each blade station and blade
1554-1693	ZPS(20,7)	Flapwise slope at each blade station and blade
1694-2533	FSV(20,6,7)	The force vector (F_x , F_y , F_z , L , M , N) in blade element axes for each blade station and blade. Note, the first index is exhausted before the second is advanced, etc.
2534-2713	STBLR(20,3,3)	The 3 X 3 transformation matrix, blade element to blade, for each station of blade 1.
2714-2853	FUNSV(20,7)	Seven functions are saved at each blade station for blade 1
		where
2714-2733		Angle of attack (radians) at each station

TABLE 20. - Continued

Location	Program Symbol	Description
2734-2753		$F_{x_{BLE}}$ aero only at each station
2754-2773		$F_{y_{BLE}}$ aero only at each station
2774-2793		$F_{z_{BLE}}$ aero only at each station
2794-2813		Blade c.g. chordwise deflections
2814-2833		Blade c.g. flapwise deflections
2834-2853		Running spanwise sum feathering torsion
2854	YFP1	Feathering axis lag slope
2855	ZFP1	Feathering axis flap slope
2856	YIS	Lag deflection at blade cuff
2857	ZIS	Flap deflection at blade cuff
2858	XCS	Longitudinal cyclic stick displacement
2859	YCS	Lateral cyclic stick displacement
2860	XCSD	Longitudinal cyclic stick rate
2861	YCSD	Lateral cyclic stick rate
2862	DEL	δ_{EL} Elevator deflection
2863	DAIL	δ_{AIL} Aileron deflection
2864	DRUD	δ_{RUD} Rudder deflection
2865	DP	δ_P Thrustor power level setting
2866	DDB	δ_{DB} Dive brake angle
2867	DFL	δ_{FL} Flap extension
2868	DIW	δ_{IW} Wing incidence angle
2869	DIHT	δ_{IHT} Horizontal tail incidence angle

TABLE 20. - Continued

Location	Program Symbol	Description
2870	THO	θ_0 Main rotor collective angle
2871	THOTR	θ_{0TR} Tail rotor collective angle
2872-3000	OUTD(129)	Auxiliary output vector. The defined elements are identified below. See Vol II, AUXOUT routine for detailed definitions.
2872		Trajectory velocity, knots
2873		Reference angle of attack, deg
2874		Reference sideslip angle, deg
2875		Reference climb angle, deg
2876		Longitudinal cycle, deg
2877		Lateral cyclic, deg
2878		Collective main rotor induced velocity
2879		Lateral induced velocity
2880		Longitudinal induced velocity
2881		Tail rotor induced velocity
2882		Rotor drive engine torque
2883		Altitude above reference
2884		Blade 1 span force at 25% R
2885		Blade 1 inplane shear at 25% R
2886		Blade 1 flap shear at 25% R
2887		Blade 1 torsion at 25% R
2888		Blade 1 flap moment at 25% R
2889		Blade 1 inplane moment at 25% R
2890		Blade 1 torsion, aero only at 25% R

TABLE 20. - Concluded		
Location	Program Symbol	Description
2891-2897		Same 7 functions as above at 50% R
2898-2904		Same 7 functions as above at 75% R
2904-3000		Future expansion

Quantities are chosen from unlabeled COMMON by number and entered in the signal location table, SLOC. Up to 200 signals can be defined. The number chosen is entered in NSIG. Each signal defined can be multiplied by a conversion factor so that output units can be controlled if desired. Conversion factors are input in the input table UC. There is a one-to-one correspondence between elements of the SLOC and UC tables. For example, suppose signal 23 is to be defined as ϕ_F in degrees.

Then

$$SLOC(23) = 153$$

$$UC(23) = 57.29578$$

Element 153 of COMMON is ϕ_F in radians. The proper conversion factor has been input in UC(23). If no conversion is desired for some signals, then the unit conversion entry can be ignored. An input of zero is interpreted as a value of one.

A 20-character label can be defined for each signal. These labels can be input in a special table, PLAB, defined as RA 5001-5200. Again, there is a one-to-one correspondence between label address and signal address. A label for the previous example would be

$$PLAB(23) = RA(5023) = \text{Roll Attitude}$$

Finally, the signal save frequency can be controlled via input in RA(43), NSAVE. If NSAVE = 1, then each signal is saved every integration step. If NSAVE = 2, then signals are saved every other integration step. If NSAVE = n, then signals are saved every n^{th} integration step.

Because of the large amount of inputs required to define the signal set, a default set is provided by the program. The default signal list of 118 signals is presented in Table 21. The default conversion factors and labels are presented in Table 22. These default values and those to be presented later should be thought of as master data which can be over-ridden.

TABLE 21. - DEFAULT SIGNAL LIST

Sig. No.	RA No.	SLOC Pointer	Quantity
1	1501	2872	Trajectory velocity
2	1502	2873	Reference angle of attack
3	1503	2874	Reference sideslip angle
4	1504	2875	Reference climb angle
5	1505	153	Roll attitude
6	1506	154	Pitch attitude
7	1507	2883	Altitude above reference
8	1508	2859	Lateral cyclic stick
9	1509	2858	Longitudinal cyclic stick
10	1510	2870	Main rotor collective angle
11	1511	2871	Tail rotor collective angle
12	1512	2865	Thrustor power lever setting
13	1513	2863	Aileron deflection
14	1514	2862	Elevator deflection
15	1515	2864	Rudder deflection
16	1516	2866	Dive brake angle
17	1517	2867	Flap extension
18	1518	2868	Wing incidence angle
19	1519	2869	Horizontal tail incidence angle
20	1520	2876	Longitudinal cyclic
21	1521	2877	Lateral cyclic
22	1522	213	Mode 1 blade 1 deflection

TABLE 21. - Continued			
Sig. No.	RA No.	SLOC Pointer	Quantity
23	1523	214	Mode 2 blade 1 deflection
24	1524	215	Mode 3 blade 1 deflection
25	1525	234	Mode 1 blade 1 velocity
26	1526	235	Mode 2 blade 1 velocity
27	1527	236	Mode 3 blade 1 velocity
28	1528	255	Mode 1 blade 1 acceleration
29	1529	256	Mode 2 blade 1 acceleration
30	1530	257	Mode 3 blade 1 acceleration
31	1531	876	Blade 1 feathering angle
32	1532	2878	WIMR
33	1533	2879	PIMR
34	1534	2880	QIMR
35	1535	2881	WITR
36	1536	958	Rotor load FF(1)
37	1537	959	FF(2)
38	1538	960	FF(3)
39	1539	961	FF(4)
40	1540	962	FF(5)
41	1541	963	FF(6)
42	1542	421	Blade 1 flap moment F(8,1)
43	1543	422	Blade 1 Inplane moment F(9,1)
44	1544	883	Blade 1 feather moment

TABLE 21. - Continued

Sig. No.	RA No.	SLOC Pointer	Quantity
45	1545	366	Hub u velocity
46	1546	367	Hub v velocity
47	1547	368	Hub w velocity
48	1548	372	Hub roll rate, p
49	1549	373	Hub pitch rate, q
50	1550	374	Hub yaw rate, r
51	1551	327	$\ddot{\phi}$ swashplate
52	1552	328	$\ddot{\theta}$ swashplate
53	1553	329	$\ddot{z}$ swashplate
54	1554	342	$\ddot{x}$ shaft
55	1555	343	$\ddot{y}$ shaft
56	1556	344	$\ddot{z}$ shaft
57	1557	345	$\ddot{\phi}$ shaft
58	1558	346	$\ddot{\theta}$ shaft
59	1559	347	$\ddot{\psi}$ shaft
60	1560	330	x shaft
61	1561	331	y shaft
62	1562	332	z shaft
63	1563	333	ϕ shaft
64	1564	334	θ shaft
65	1565	335	ψ shaft
66	1566	186	Reference $\dot{u}$

TABLE 21. - Continued			
Sig. No.	RA No.	SLOC Pointer	Quantity
67	1567	187	Reference $\dot{v}$
68	1568	188	Reference $\dot{w}$
69	1569	387	Fuselage $\dot{p}$
70	1570	388	Fuselage q
71	1571	389	Fuselage $\dot{r}$
72	1572	983	FTR(2)
73	1573	982	FTR(1)
74	1574	988	FP(1)
75	1575	970	FN(1)
76	1576	971	FN(2)
77	1577	972	FN(3)
78	1578	973	FN(4)
79	1579	974	FN(5)
80	1580	975	FN(6)
81	1581	384	Fuselage p
82	1582	385	Fuselage q
83	1583	386	Fuselage r
84	1584	2882	Rotor drive torque
85	1585	216	Mode 1 blade 2 deflection
86	1586	217	Mode 2 blade 2 deflection
87	1587	218	Mode 3 blade 2 deflection
88	1588	219	Mode 1 blade 3 deflection

TABLE 21. - Continued

Sig. No.	RA No.	SLOC Pointer	Quantity
89	1589	220	Mode 2 blade 3 deflection
90	1590	221	Mode 3 blade 3 deflection
91	1591	222	Mode 1 blade 4 deflection
92	1592	223	Mode 2 blade 4 deflection
93	1593	224	Mode 3 blade 4 deflection
94	1594	225	Mode 1 blade 5 deflection
95	1595	226	Mode 2 blade 5 deflection
96	1596	227	Mode 3 blade 5 deflection
97	1597	318	Rotor speed, ψ_R
98	1598	319	Rotor acceleration, ψ_R
99	1599	2872	Trajectory velocity
100	1600	2873	Reference angle of attack
101	1601	2875	Reference climb angle
102	1602	948	FR(3) rotor thrust
103	1603	946	FR(1) rotor drag
104	1604	951	FR(6) rotor torque
105	1605	942	QLOADS(3) airframe lift
106	1606	940	QLOADS(1) airframe drag
107	1607	944	QLOADS(5) airframe pitch
108	1608	983	FTR(2) Tail rotor thrust
109	1609	988	FP(1) AUX. Thrust
110	1610	2859	Lateral cyclic stick

TABLE 21. - Concluded			
Sig. No.	RA No.	SLOC Pointer	Quantity
111	1611	2858	Longitudinal cyclic stick
112	1612	2870	Main rotor collective angle
113	1613	2871	Tail rotor collective angle
114	1614	2865	Thrustor power lever setting
115	1615	2878	WIMR
116	1616	2879	PIMR
117	1617	2880	QIMR
118	1618	362	Reference $\ddot{z}$

TABLE 22. - DEFAULT UNIT FACTORS AND TITLES			
Sig. No.	Factor	Note: Units given below only reflect current title set stored in program. Title	
1	1.	TRAJECT VEL FT/SEC	
2	1.	ANGLE OF ATTACK DEG	
3	1.	SIDESLIP DEG	
4	1.	ANGLE OF CLIMB DEG	
5	57.3	ROLL ATTITUDE DEG	
6	57.3	PITCH ATTITUDE DEG	
7	1.	ALTITUDE GAIN FT	
8	12.	LAT CYCLIC STICK IN	
9	12.	LONG CYCLIC STICK IN	

TABLE 22. - Continued

Sig. No.	Factor	Title
10	57.3	COLLECTIVE DEG
11	57.3	TAIL ROTOR COL DEG
12	1.	JET SETTING PCT
13	57.3	AILERONS DEG
14	57.3	ELEVATOR DEG
15	57.3	RUDDER DEG
16	57.3	DIVE BRAKE DEG
17	57.3	FLAPS DEG
18	57.3	WING INC DEG
19	57.3	TAIL INC DEG
20	1.	LATERAL CYCLIC DEG
21	1.	LONG CYCLIC DEG
22	1.	MODE 1 DISPL FT
23	1.	MODE 2 DISPL FT
24	1.	MODE 3 DISP FT
25	1.	MODE 1 VEL FT/SEC
26	1.	MODE 2 VEL FT/SEC
27	1.	MODE 3 VEL FT/SEC
28	1.	MODE 1 ACCEL FT/SEC ²
29	1.	MODE 2 ACCEL FT/SEC ²
30	1.	MODE 3 ACCEL FT/SEC ³
31	57.3	BL1 FEATHER ANGL DEG

TABLE 22. - Continued		
Sig. No.	Factor	Title
32	1.	COLL DOWNWASH FT/SEC
33	1.	LAT DOWNWASH FT/SEC
34	1.	LONG DOWNWASH FT/SEC
35	1.	TR DOWNWASH FT/SEC
36	1.	ROTOR LONG SHEAR LBS
37	1.	ROTOR LAT SHEAR LBS
38	1.	ROTOR THRUST LBS
39	1.	ROTOR ROLL M FT-LBS
40	1.	ROTOR PITCH M FT-LBS
41	1.	ROTOR TORQ FT-LBS
42	1.	BL1 FLAP MOM FT-LBS
43	1.	BL1 INPL MOM FT-LBS
44	1.	BL1 FEATHER M FT-LBS
45	1.	HUB U FT/SEC
46	1.	HUB V FT/SEC
47	1.	HUB W FT/SEC
48	57.3	HUB P DEG/SEC
49	57.3	HUB Q DEG/SEC
50	57.3	HUB R DEG/SEC
51	57.3	SP PHIDD DEG/SEC2
52	57.3	SP THTDD DEG/SEC2
53	1.	SP VERT ACCL FT/SEC2

TABLE 22. - Continued

Sig. No.	Factor	Title
54	1.	SHAFT XDD FT/SEC2
55	1.	SHAFT YDD FT/SEC2
56	1.	SHAFT ZDD FT/SEC2
57	57.3	SH PHIDD DEG/SEC2
58	57.3	SH THTDD DEG/SEC2
59	57.3	SH PSIDD DEG/SEC2
60	12.	SHAFT X DISPL IN
61	12.	SHAFT Y DISPL IN
62	12.	SHAFT Z DISPL IN
63	57.3	SHAFT ROLL DEG
64	57.3	SHAFT PITCH DEG
65	57.3	SHAFT YAW DEG
66	1.	REF U DOT FT/SEC2
67	1.	REF V DOT FT/SEC2
68	1.	REF W DOT FT/SEC2
69	57.3	FUS PDOT DEG/SEC2
70	57.3	FUS QDOT DEG/SEC2
71	57.3	FUS RDOT DEG/SEC2
72	1.	TAIL RTR THRUST LBS
73	1.	TAIL RTR DRAG LBS
74	1.	JET THRUST LBS
75	1.	FUSELAGE FX LBS

TABLE 22. - Continued

Sig. No.	Factor	Title
76	1.	FUSELAGE FY LBS
77	1.	FUSELAGE FZ LBS
78	1.	FUSELAGE MY FT-LBS
79	1.	FUSELAGE MY FT-LBS
80	1.	FUSELAGE MZ FT-LBS
81	57.3	FUSELAGE P DEG/SEC
82	57.3	FUSELAGE Q DEG/SEC
83	57.3	FUSELAGE R DEG/SEC
84	1.	ENG TORQ FT-LBS
85	1.	BL2 MODE 1 FT
86	1.	BL2 MODE 2 FT
87	1.	BL2 MODE 3 FT
88	1.	BL3 MODE 1 FT
89	1.	BL3 MODE 2 FT
90	1.	BL3 MODE 3 FT
91	1.	BL4 MODE 1 FT
92	1.	BL4 MODE 2 FT
93	1.	BL4 MODE 3 FT
94	1.	BL5 MODE 1 FT
95	1.	BL5 MODE 2 FT
96	1.	BL5 MODE 3 FT
97	1.	BL1 AZM

TABLE 22. - Concluded

Sig. No.	Factor	Title
98	1.	RTRSPEED
99	1.	TRAJ VLL
100	1.	ATAK ANG
101	1.	CLIMBANG
102	1.	TOTRLIFT
103	1.	ROTRDRAG
104	1.	RC RTTORQ
105	1.	FUSLLIFT
106	1.	FUSLDRAG
107	1.	FUSPITCH
108	1.	TRTHRUST
109	1.	JETTHRST
110	1.	LAT STIK
111	1.	LONGSTIK
112	1.	COLLECTV
113	1.	TAILRCOL
114	1.	JETSETNG
115	1.	COLDWASH
116	1.	LATDWASH
117	1.	LNGDWASH
118	-0.03108	LOAD FACTOR

3.4.5.2 Print output. - A subset of the signal set may be selected for print output. The printed output is in block form at selected time points. Up to six lines of eight parameters each constitute a block. Thus, a maximum of 48 parameters can be printed. Table 23 contains the print control information. Note, the print pointer list, PP, identifies the signals to be printed. The signals are identified by their relative location within the SLOC table. The range of values within the PP array is therefore 200. The total number of parameters to print is entered in NPP. The input PFREQ controls the print frequency. If no value is input, the first and last time points will be printed. All time history printing can be suppressed by turning off the IPRINT flag.

TABLE 23. - PRINT CONTROL PARAMETERS		
Input Quantity		Address
IPRINT	Print control flag. #0, print.	49
PFREQ	Print sampling control based on recorded signal steps. Default is first and last time points.	2899
NPP	Number of signals to be printed.	2900
PP	Print signal pointer list.	2901-2948

Again, a default set of values is provided by the program. These default values can be thought of as master data. Thus, they can be modified via input. See Table 24.

TABLE 24. - DEFAULT PRINT LIST AND TITLES

Print No.	Sig. No.	Title
1	97	BL1 AZM
2	98	RTRSPEED
3	99	TRAJ VEL
4	100	ATAK ANG
5	3	SIDESLIP
6	101	CLIMBANG
7	6	PITCH AT
8	5	ROLL ATT
9	102	TOTRLIFT
10	103	ROTRDRAG
11	104	ROTRTORQ
12	105	FUSLLIFT
13	106	FUSLDRAG
14	107	FUSPITCH
15	108	TRTHRUST
16	109	JETTHRST
17	110	LAT STIK
18	111	LONGSTIK
19	112	COLLECTV
20	113	TAILRCOL
21	14	ELEVATOR
22	13	AILERONS
23	15	RUDDER
24	114	JFTSETNG
25	17	FLAPS
26	16	DIVE BRA
27	18	WING INC
28	19	TAIL INC
29	115	COLDWASH
30	116	LATDWASH
31	117	LNGDWASH

3.4.5.3 Plot output. - A subset of the signal set may be selected for CALCOMP plotting. The input parameters which control plotting are presented in Table 25. If the plotting flag, IPLOT, is zero then no plots will be generated. If IPLOT is not zero, then the NVAR = n signals identified in the NVEC array will be plotted. There are two pieces of information encoded within each entry in the NVEC array. Not only does each entry identify which signal to plot, but it also defines an ordinate label to identify sign polarity. The encoding is accomplished as follows. Each input in the NVEC array is a floating point number of the form XX.YY. The part of the number denoted YY, identifies the signal number. The component XX is an identifier ranging from 00 to 09 which gives the ordinate label polarity indicator desired. These indicators are defined in Table 26. An example follows. Assume the first three signals to be plotted are signals 22, 40, and 155. With no ordinate label specified for 22, a nose up label for 40 and an aft label for 155. Then the NVEC entries would be the following

```

NVEC(1) = 22.0
      (2) = 2040.0
      (3) = 7155.0

```

Ordinate scaling for each signal is normally handled automatically by the program. Each signal is scaled to a 2-inch channel. However, the user can input ordinate scale factors for desired signals in the proper slots of the SVEC array. SVEC(n) is the scale factor for the signal NVEC(n).

Abscissa scaling can also be controlled by the user. The user specifies in TSCLE how many units per inch, and specifies by CYCFLG if the units are cycles or seconds.

Finally, as an aid to the user, a default list of signals to be plotted is provided by the program. These inputs can of course be overridden. The default list is presented in Table 27.

A note concerning the order of output is necessary. Plotting is frame oriented with the first four signals plotted in frame one with the sequence being from bottom to top, the second frame holds signals 5-8, etc. Figure 6 presents a sample plot output frame.

TABLE 25. - PLOT CONTROL PARAMETERS		
Input Quantity		Address
IPL0T	Plot control flag. A non-zero value will invoke plots.	48
CYCFLG	Plot abscissa scale selector; = 0. gives seconds/inch; = 1. gives cycles/inch.	134
TSCLE	Plot abscissa scale factor, units per inch. CYCFLG determines the unit definition.	298
NVAR	Number of signals to be plotted, i.e., the number of entries in NVEC.	300
NVEC	Plot signal pointer table.	1801-1900
SVEC	Plot signal scale factors. Matches NVEC list. Other- wise, automatic scaling.	2401-2500

TABLE 26. - PLOT POLARITY LABELS	
Label	Code (XX)
(blank)	00
RT	01
N UP	02
N DN	03
UP	04
DN	05
FWD	06
AFT	07
N RT	08
N LT	09

TABLE 27. - DEFAULT PLOT LIST AND TITLES			
Plot No.	Sig No.	Polarity	Title
			Note: Units given below only reflect current title set stored in program.
1	1	FWD	TRAJECT VEL FT/SEC
2	2	N VP	ANGLE OF ATTACK DEG
3	3	N LT	SIDESLIP DEG
4	118	UP	LOAD FACTOR
5	8	RT	LAT CYCLIC STICK IN
6	9	AFT	LONG CYCLIC STICK IN
7	10	UP	COLLECTIVE DEG
8	7	UP	ALTITUDE GAIN FT
9	5	RT	ROLL ATTITUDE DEG
10	6	N UP	PITCH ATTITUDE DEG
11	11	()	TAIL ROTOR COL DEG
12	12	)	JET SETTING PCT
13	13	UP	AILERONS DEG
14	14	UP	ELEVATOR DEG
15	15	RT	RUDDER DEG
16	24	()	MODE3 DISPL FT
17	66	FWD	REF UDOT FT/SEC2
18	67	RT	REF VDOT FT/SEC2
19	68	DN	REF WDOT FT/SEC2
20	69	RT	FUS PDOT DEG/SEC2
21	70	N UP	FUS QDOT DEG/SEC2
22	71	N RT	FUS ROOT DEG/SEC2

TABLE 27. - Continued

Plot No.	Sig No.	Polarity	Title
23	72	RT	TAIL RTR THRUST LBS
24	74	FWD	JET THRUST LBS
25	81	RT	FUSELAGE P DEG/SEC
26	82	N UP	FUSELAGE Q DEG/SEC
27	83	N RT	FUSELAGE R DEG/SEC
28	84	RT	ENG TORQ FT-LBS
29	40	N UP	ROTOR PITCH M FT-LBS
30	41	RT	ROTOR TORQ FT-LBS
31	45	FWD	HUB U FT/SEC
32	46	RT	HUB V FT/SEC
33	47	DN	HUB W FT/SEC
34	48	RT	HUB P DEG/SEC
35	49	N UP	HUB Q DEG/SEC
36	50	N RT	HUB R DEG/SEC
37	51	RT	SP PH1DD DEG/SEC2
38	52	N UP	SP THTDD DEG/SEC2
39	53	DN	SP VERT ACCL FT/SEC2
40	54	FWD	SHAFT XDD FT/SEC2
41	55	RT	SHAFT YDD FT/SEC2
42	56	DN	SHAFT ZDD FT/SEC2
43	57	RT	SH PH1DD DEG/SEC2
44	58	N UP	SH THTDD DEG/SEC2

TABLE 27. - Concluded			
Plot No.	Sig No.	Polarity	Title
45	59	N RT	SH PS1DD DEG/SEC2
46	60	FWD	SHAFT X DISPL IN
47	61	RT	SHAFT Y DISPL IN
48	62	DN	SHAFT Z DISPL IN
49	20	N DN	LATERAL CYCLIC DEG
50	21	N DN	LONG CYCLIC DEG
51	22	()	MODE1 DISPL FT
52	23	()	MODE2 DISPL FT
53	42	UP	BL1 FLAP MOM FT-LBS
54	43	FWD	BL1 INPL MOM FT-LBS
55	44	N UP	BL1 FEATHER M FT-LBS
56	31	N UP	BL1 FEATHER ANGL DEG
57	36	FWD	ROTOR LONG SHEAR LBS
58	37	RT	ROTOR LAT SHEAR LBS
59	38	DN	ROTOR THRUST LBS
60	30	RT	ROTOR ROLL M FT-LBS
61	32	()	COLL DOWNWASH FT/SEC
62	33	()	LAT DOWNWASH FT/SEC
63	34	()	LONG DOWNWASH FT/SEC
64	35	()	TR DOWNWASH FT/SEC

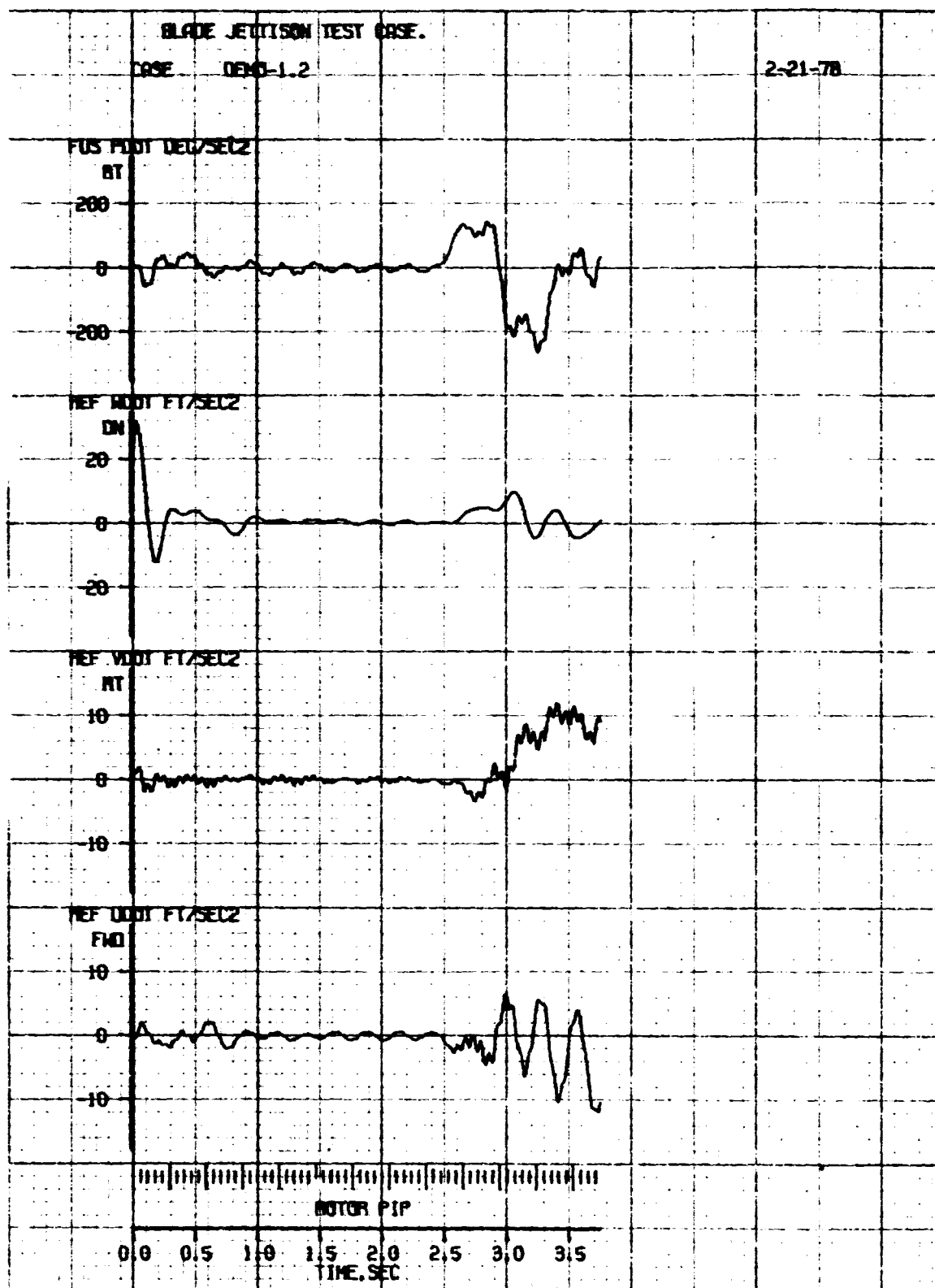


Figure 6. - Sample CALCOMP plot output.

3.4.5.4 Harmonic analysis. - The program provides harmonic analysis output for up to 50 signals. The output consists of the Fourier coefficients

$$a_0 = \frac{1}{2\pi} \int_0^{2\pi} f(x) dx$$

$$a_n = \frac{1}{\pi} \int_0^{2\pi} f(x) \cos nx \, dx$$

$$b_n = \frac{1}{\pi} \int_0^{2\pi} f(x) \sin nx \, dx$$

for $n = 1, \dots, 8$ (8 harmonics).

The data are also presented as phase-amplitude information. Where

$$A_n = \sqrt{a_n^2 + b_n^2}$$

$$\theta_n = \tan^{-1}\left(\frac{b_n}{a_n}\right) \cdot \left(\frac{360}{2\pi}\right) / n$$

if $b_n < 0$ then $\theta_n = \theta_n + 360/n$.

Harmonic output is signaled with a nonzero input in IHAFLG (RA 1257). The functions to be analyzed must be given in the general output signal set as defined by RA's 1501-1700. The subset to be analyzed is identified with pointers input in the array HSIG (RA 2301-2350). The number of signals, NHSIG, is RA 2300. The user is reminded that the signal save frequency can be input in RA 43. If this input is ignored, the program will guarantee that at least 20 points per cycle will be saved. For proper harmonic coefficient definition, NSAVE (RA 43) must be a divisor of the integration interval, NAZ (RA 51).

The harmonic analysis output flag, IHAFLG, will also serve as an input to the program describing at which cycle to sample the signal. This is a cycle count measured from the end of trim. The inputs described above are summarized in Table 28.

TABLE 28. - HARMONIC ANALYSIS PARAMETERS

Input Quantity		Address
IHAFLG	Harmonic Analysis flag. A nonzero value activates harmonic analysis over the cycle indicated.	1257
NHSIG	The number of signals to analyze, i.e., number of entries in HSIG table.	2300
NSIG	Harmonic analysis signal pointer table.	2301-2350

3.4.5.5 Diagnostic outputs. - The program provides a modest amount of diagnostic print output which can be helpful in isolating input and model problems. The inputs which control the diagnostics are presented in Table 29, and are discussed below.

TABLE 29. - DIAGNOSTIC OUTPUT PARAMETERS

Input Quantity		Address
MATGEN	Acceleration perturbation and mass matrix generation flag. A nonzero value activates.	31
ISWP	SWEEP routine diagnostic print flag and counter. If ISWP = n then diagnostics will be printed upon the first n entries into SWEEP.	45
MATPRT	Mass Matrix print flag. If MATPRT $\neq$ 0 then the initial generalized mass matrix will be printed.	46

The initially computed generalized mass matrix can be optionally printed by turning on the input MATPRT. It should be stated that if the program senses a nonpositive definite matrix at any time during operation, the current mass matrix is printed and the case aborted.

Detailed data concerning each main rotor blade can be printed in time history form by activating the input ISWP. The input ISWP serves as a counter which limits the printing to the first n time points. All the data are computed and printed from subprogram SWEEP. The output requires a listing of subprogram SWEEP to decode the parameters from the write statements.

The final diagnostic output to be discussed is the acceleration perturbation and mass matrix generation flag, MASGEN. If this flag is activated, a time history is not computed. Instead, the generalized mass matrix is

computed, based on the initial inputs. Then, a generalized mass matrix is constructed through perturbation of each generalized acceleration. Where for each acceleration, $\ddot{q}_j$,

$$M_{ij} = \frac{\partial \Delta F_i}{\partial \ddot{q}_j}, \quad i = 1, \dots, \text{NTOTL}.$$

This derived mass matrix should theoretically match the computed mass matrix. Also, the derived matrix is a full matrix, and can be checked for symmetry. This method can be effective in spotting obvious program errors.

3.4.5.6 Data utilities. - The inputs presented in Table 30 can be used to initiate two useful data utility functions.

TABLE 30. - DATA UTILITY PARAMETERS		
Input Quantity		Address
IPUNCH	Trim punch flag. If IPUNCH $\neq$ 0, then a trim punch deck is produced.	47
EDIT	Master data deck punch flag.	104

The input IPUNCH activates a trim punch option. The values of the parameters listed in Table 17 will be punched at the end of trim. The card deck produced can then be used as a change data unit in a subsequent run. These updated inputs should comprise a better set of initial conditions.

A data deck editing feature is also available. If EDIT (RA 104) = 1. is inserted in the data deck in either a master or change data unit, an uncluttered master data unit will be produced. This new deck will include the current nonzero values of all addresses in the range 1-3000 with the exception of RA 104. The deck will be headed by a master control card, and terminate with an end control card. This option is useful when numerous changes have been made to a master data deck, or the deck has several master overrides.

3.4.6 Main rotor blade.

3.4.6.1 Geometry. - The program takes a straight line radiating from the shaft at the hub center and builds up the blade reference line which is taken to pass through the quarter chord line. REXOR II blade station locations are in the array, SX. Do not use more than 20 stations.

At each spanwise station the chordwise location of a number of blade element properties are specified. These are the element center of gravity, the neutral axis, and the shear center. Note again that these data are specified with respect to the quarter-chord line. These data are summarized in Table 31.

TABLE 31. - BLADE STATION REFERENCE DIMENSIONS		
Input Quantity		Address
NB	No. of blades	1
NRAD	No. of blade stations	498
SX	Blade station locations, m (ft)	501-520
SY	Blade element c.g. location relative to the quarter chord	521-540
YNA	Location of neutral axis relative to quarter chord	1441-1460
YCS	Location of shear center relative to quarter chord	1421-1440

A number of other items are tabulated at blade stations such as mass, torsion, and model data. These will be presented in their respective sections.

Geometric twist, θ_{TW} , and coning β_o , are additional inputs. Coning is assumed to start at the shaft center line. Other inputs include blade droop angle relative to the precone angle, γ , blade sweep, τ_o , and offsets Y_{jog} and Z_{jog} . All of these design parameters are measured at a specified blade location termed STA70. STA70 is an input m (feet), and does not necessarily correspond to a station location. This location is often the location at which the movable hub attaches to the blade proper.

The feather bearing locations are described by two inputs. These are the location of an inboard bearing FBLOC and the distance between bearings, DBEAR. Both locations must be specified to permit computing the feather axis slope from the bearing displacements. The program internally computes the offset of the bearings above and below the blade reference axis on the assumption the feather axis crosses the blade axis midway between bearings. The feather axis geometric coning is specified as BFAS. An additional offset, DELZOB, can be specified for the outboard bearing. Care should be exercised as the geometric coning the program uses will be increased above that specified by BFAS to account for DELZOB.

Finally, the blade radius, R , and chord, $CORD$, a constant over the blade, are required. All of these geometric inputs are fully discussed in Volume I in Section 4.5.5. They are summarized in Table 32.

TABLE 32. - BLADE ANGLES, OFFSETS, AND DIMENSIONS			
Input Quantity			Address
R	R	Blade radius, m (ft)	81
θ_1	TH1	Geometric twist, deg	85
c	CORD	Main rotor blade chord, m (ft)	110
l_{IB}	FBLOC	Inboard bearing location, m (ft)	128
l_B	DBEAR	Distance between bearings, m (ft)	129
β_0	BETA	Blade cone angle, deg	1266
τ_0	TAU	Blade sweep, deg	
γ	CAMMA	Blade droop, deg	
β_{FA}	BFAS	Blade bearing cone angle	1270
ΔZ_{OB}	DELSOB	Outboard bearing offset adjustment	1479
Y_{jog}	YJOG	Blade chordwise offset, m (ft)	1481
Z_{jog}	ZJOG	Blade flapwise offset, m (ft)	1482
X_{SW}	STA70	Location where sweep and droop begin	2570

3.4.6.2 Blade bending modes and related data. - Each blade bending mode has a chordwise and flapwise displacement component, but not an elastic twist component. Cases are usually run with three bending modes, but less can be used. Torsion and pitch horn bending are treated separately (see Sections 3.4.6.4 and 3.4.6.5 for a discussion of inputs).

Typically, mode 1 is taken to be the first inplane, mode 2 the 1st flap, and mode 3 the 2nd flap. Each mode is presented to the program in an array where the row index (first) corresponds to blade station and the column index (second) identifies which displacement or slope. For instance, the mode 1 chordwise displacement at station one is $BMSM1(1,1)$, the flapwise displacement is $BMSM1(1,2)$, the chordwise and flapwise slopes are $BMSM1(1,3)$ and $BMSM1(1,4)$. The mode shapes are defined by completing the first index for

the specified blade stations. A normalization based on the tip chord or flap displacement, whichever is greater, has been frequently used. Any normalization can be used but output labels are based on unit tip values.

The chordwise and flapwise components are equal to the inplane and out-plane displacements at a reference feather angle given by PHIREF. The program rotates the modes with the feather angle so that the bending components are in axes fixed to the blade. A rotor speed, Ω , is also specified when the mode shapes are computed. The rotor speed for a given case should be reasonably close to this specified speed. The rotor speed input location, RA(52), has already been discussed.

All modes are nominally with the chordwise/displacement positive forward and the flapwise displacement positive down. The program reverses the sign on the flapwise component internally to match BLn axes convention.

Modal data are also needed at the feather bearing stations. For mode 1, FBLM(1,1) is the chordwise displacement and FBLM(2,1) is the flapwise displacement at the inboard bearing station. FBLM(1,2) and FBLM(2,2) are the corresponding values for the outboard bearing station. Mode 2 and 3 bearing deflections are similarly specified.

Additional modal data are required when the program is computing a lag damper configuration. The damper angular displacement is YP(1) for mode 1, YP(2) for mode 2, and YP(3) for mode 3.

The bending modes produce a feather angle component given by the partial derivatives TPV(1), TPV(2) and TPV(3) for modes 1, 2, and 3. These factors are defined as radians of feather angle per unit modal deflection.

The modal inputs discussed are summarized in Table 33.

TABLE 33. - BLADE MODAL DATA		
Input Quantity		Address
IM1	Mode 1 select flag = 1. on; = 0. off	2
IM2	Mode 2 select flag = 1. on; = 0. off	3
IM3	Mode 3 select flag = 1. on; = 0. off	4
BMSM1(1,1)	Y displacement, 1st mode	761-780
BMSM1(1,2)	Z displacement, 1st mode	781-800
BMSM1(1,3)	dY/dS, 1st mode	801-820
BMSM1(1,4)	dZ/dS, 1st mode	821-840
BMSM2(1,1)	Y displacement, 2nd mode	841-860

TABLE 33. - Continued

Input Quantity		Address
BMSM2(1,2)	Z displacement, 2nd mode	861-880
BMSM2(1,3)	dY/dS, 2nd mode	881-900
BMSM2(1,4)	dZ/dS, 2nd mode	901-920
BMSM3(1,1)	Y displacement, 3rd mode	921-940
BMSM3(1,2)	Z displacement, 3rd mode	941-960
BMSM3(1,3)	dY/dS, 3rd mode	961-980
BMSM3(1,4)	dZ/dS, 3rd mode	981-1000
PHIREF	Blade reference feather angle, deg	1269
Feather Bearing Mode 1:		
FBLM1(1,1)	Inboard Y displacement	275
(2,1)	Z	276
(1,2)	Outboard Y	277
(2,2)	Z	278
Feather Bearing Mode 2:		
FBLM2(1,1)	Inboard Y displacement	279
(2,1)	Z	280
(1,2)	Outboard Y	281
(2,2)	Z	282
Feather Bearing Mode 3:		
FBLM3(1,1)	Inboard Y displacement	283
(2,1)	Z	284
(1,2)	Outboard Y	285
(2,2)	Z	286
Lead-lag damper angular deflection:		
YP(1)	Mode 1	367
(2)	2	368
(3)	3	369

TABLE 33. - Concluded

Input Quantity		Address
TPV(1)	Mode 1 to feather coupling factor	145
TPV(2)	Mode 2 to feather coupling factor	146
TPV(3)	Mode 3 to feather coupling factor	147

The program computes the centrifugal stiffness by adding the centrifugal acceleration in with the other accelerations when the generalized mode force is found. Only the structural stiffness is required as input. This is presented as a 3 by 3 matrix, BLADK. Consult Volume I, Section 5.6.4 for a formulation for this symmetric spring matrix. The off-diagonal terms cross couple modes, as would be expected even for orthogonal modes. The units given in the input tabulation for the spring and other modal constants assume the modal displacement components are given in feet and the slope in radians. The modal degrees of freedom have units of time. Units, however, are not indicated for the modal components to indicate these can be arbitrarily normalized.

The structural damping in each mode is the same. Its contribution to the generalized force is

$$\frac{\partial B}{\partial \dot{A}_{mn}} = c \sum_{j=1}^3 K_{mj} \dot{A}_{jn}$$

for mode m, blade n. The damping constant can be interpreted as

$$c = 2 \zeta \omega_0$$

where ζ is the damping ratio at the natural frequency ω_0 of interest. Three inputs control the damping level c: CTRIM, CFLY and CZERO. The program linearly interpolates between CZERO and CTRIM for the first second in TRIM. CTRIM should have a value equal to CFLY or close to it. CZERO is set high, a value of 0.0156 being typical, to quiet the inplane mode promptly. This mode typically has low damping and would otherwise take an excessive time in TRIM to reach a steady state. The damping function is shown in Figure 7.

The usual linear damper, if incorporated, is modeled as a rotary equivalent damper acting about a real or virtual lead-lag hinge. The damper motion is described by the modal coefficients YP(1), YP(2) and YP(3), which are described with the blade modal data.

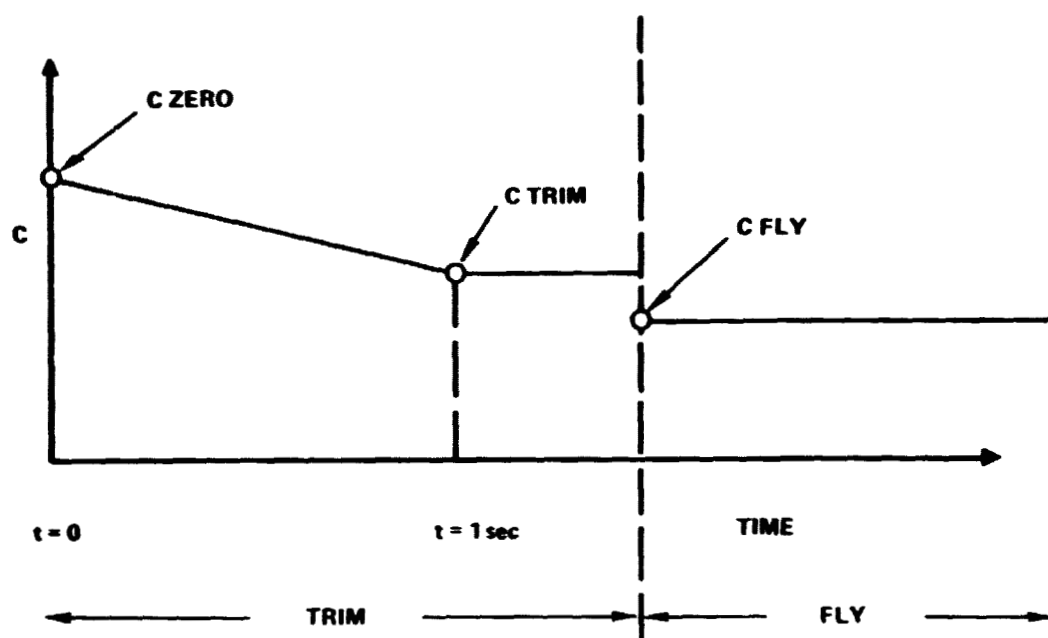


Figure 7. TRIM-FLY damping function.

The damper is modeled as a basic damping coefficient CLAG1 up to an actuation rate of YPDI radians/sec. At this point a relief valve in the damper opens, and additional damping above (CLAG1)(YPDI) is obtained with a damping coefficient of CLAG2. The equations of the damper mechanism are given in Volume I, Section 5.6.4.1.

Structural and damping coefficient data are summarized in Table 34.

TABLE 34. - STRUCTURAL AND DAMPING COEFFICIENT DATA		
Input Quantity		Address
BLADK(3,3)	Blade stiffness matrix	1241-1249
CZERO	Blade modal damping at trim initialization	1252
CTRIM	Blade damping after 1 sec of TRIM	1250
CFLY	Fly modal damping	1251
CLAG1	Inplane lag damper constant	370
CLAG2	High rate damping constant	371
YPDI	Damping rate breakpoint	439

3.4.6.3 Blade aerodynamics. - The blade aerodynamic data in REXOR II is arranged to be compatible with C-81 airfoil data decks. The data tables return C_l , C_d , and C_m for Mach number and angle-of-attack entries. The program has provisions for two sets of tables. The step from use of table set 1 to set 2 occurs at blade station KAERO. Set 2 is used outboard of this station. A NACA 0012 data set is stored internally in set 2. Thus the second of two external data sets will override the internal 0012 set. All the representations use a blade root cutout (drag only, no lift or moment) identified as CUTOUT = RA(2688).

Unsteady aerodynamics (lift at the quarter chord determined by airflow at the 3/4 chord) can be deleted by setting the UNSTDY flag, RA(50) = 1.

Once the table values are determined, an increment to the drag coefficient can be added at every station by the input DELCD. Further, an increment, DCMR, to the pitching moment coefficient resulting from a trailing-edge tab can be added between the inboard and outboard ends of that tab as specified by the inputs KTI and KTO. DCMR is added when

$$KTI \leq K \leq KTO$$

where K is the REXOR II station index.

In addition to the root cutout, REXOR II also computes only a drag for the outboard blade segment. Thus, a tip loss factor can be implicitly applied by proper choice of the REXOR station just inboard of the tip. The relationship is

$$SX(NRAD-1) = R*(2B-1)$$

where R is the blade radius and BTIF is the tip loss factor.

A further refinement may be made known as dynamic stall. Dynamic stall is triggered by setting ISTALL = 1. A reference angle factor, FACTM, is required. A description of its nature is found in Volume I, Section 6.2.3.4.2. Nonlinear aerodynamic inputs are summarized in Table 35.

TABLE 35. - NONLINEAR BLADE AERO DATA		
	Input Quantity	Address
KAERO	Table crossover station	44
DELCD	Blade element incremental C_D	1264
KTI	Inbound blade tab station number	1345
KTO	Outboard blade tab station number	1346
DCMR	Incremental C_M for blade tab	1256
BTIP	Tip loss factor	380
ISTALL	Dynamic stall simulation flag	2555
FACTM	Reference angle factor	2559
UNSTDY	Unsteady aerodynamics deletion flag, = 1. delete	50

3.4.6.4 Pitch horn bending. - The program can be directed to simulate quasi-static or dynamic pitch horn bending. If no bending is desired, then only the pitch horn length is required, E. (RA 136). If KPH is nonzero, then quasi-static bending is assumed. The input KPH also serves as the pitch horn spring in foot-pounds of feathering moment per radian of elastic feathering. A time constant, TPH, is also required. Since a first order lag is simulating the dynamics, the time constant could be roughly the reciprocal of the natural frequency of the pitch horn bending mode.

Dynamic pitch horn bending is activated by setting NBP = 1. The dynamic pitch horn should not be used with either quasi-static pitch horn bending or dynamic torsion. The pitch horn degrees of freedom for each blade are independent. The dynamic pitch horn requires a spring, AKPH, and a partial, ZBPH. If ZBPH = 1, the amount the end of the pitch horn displaces will be feet per radian of elastic feathering. If ZBPH = E = RA(136), the pitch horn displacement is in terms of the actual feathering displacements. Therefore, no units are given for ZBPH. The units listed in the input tabulation for AKPH assumes the ZBPH is identically one. The pitch horn bending inputs are given in Table 36.

TABLE 36. - PITCH HORN BENDING INPUTS		
Input Quantity		Address
E	Pitch horn length	136
KPH	Quasi-static pitch horn spring	1487
TPH	Quasi-static pitch horn time constant	1488
NBP	Pitch horn bending degree of freedom flag	5
ZBPH	Pitch horn partial	1477
AKPH	Pitch horn spring	1478

3.4.6.5 Torsion. - Quasi-static or dynamic torsion capabilities are available. Quasi-static torsion is signaled by the input flag TORFLG. Other inputs include a time constant TCT, and DSOGJ which is the reciprocal of the torsional stiffness. The time constant, TCT, is for a first-order simulation of the torsion dynamics. To alleviate numerical difficulties, however, the elastic twist velocity is not used in the computations, only the displacements. Nevertheless, a value for the time constant roughly equal to the reciprocal of the natural frequency of the torsion mode is appropriate. The required quantities are presented in Table 37.

Dynamic torsion is activated by setting NPT = 1. Dynamic torsion (an uncoupled mode) cannot be used at the same time as dynamic pitch horn bending. For uncoupled torsion, a mode shape starting at RA(2871) = PPTOR(1) is required. As usual, any normalization will work, but for output consistency one radian nose up twist at the blade tip is suitable. The quantities needed are reviewed in Table 38.

TABLE 37. - QUASI-STATIC TORSION		
Input Quantity		Address
TORFLG	Quasi-static torsion flag	1497
TCT	Quasi-static time constant	1401
DSOGJ	Reciprocal of torsional stiffness at every REXOR station	1361-1380

TABLE 38. - DYNAMIC TORSION INPUTS		
Input Quantity		Address
NPT	Blade torsion degree of freedom flag	6
PPTOR	Torsion mode shape at each blade data station	2871-2890
TORK	Dynamic torsion root spring	126
TORC	Dynamic torsion root damper	127

3.4.6.6 Feather bearing loads. - Feather bearings are modeled in REXOR II having the properties of a torsional spring rate, friction, and damping. The spring can be due to the bearings or from some other physical source such as tension-torsion packs, if used. The spring rate is TXS.

Bearing friction can be modeled as stiction or viscous friction, or a combination thereof. Figure 8 illustrates the nature of friction function.

Stiction is modeled if RLF is a small number (not zero) and FCF is the stiction load. If only viscous friction is desired without a stiction limit, then RLF must be much larger than the normal range of the velocity, and the ratio FCF/RLF determines the viscous damping coefficient.

Viscous damping can also be supplied via the input CFB. The inputs are summarized below in Table 39.

TABLE 39. - FEATHER BEARING LOADS		
Input Quantity		Address
TXS	Feather spring	294
CFB	Feathering viscous friction	1485
FCF	Feather friction	114
RLF	Feather stiction break point	115

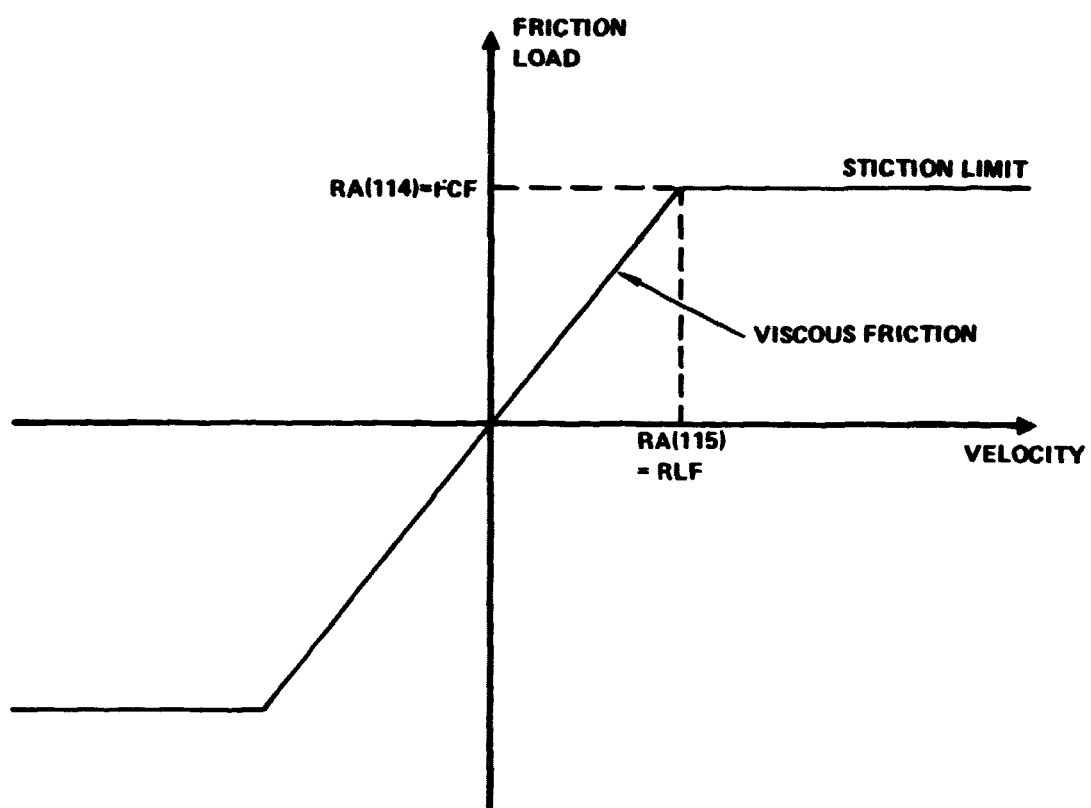


Figure 8. Feather bearing friction.

3.4.7 Weight and balance. - The total mass of the vehicle is the sum of mass of its parts. The required inputs are specified in Table 40.

The program integrates the blade distributed mass and then adds up all the blades to find the rotor mass. The blade mass is defined as all the masses that can be feathered. The remainder of the rotating masses are included in the hub mass.

TABLE 40. - MASS DATA TABLE		
Input Quantity		Address
FMASS	Fuselage, including wings and tail surfaces, tail rotor and engine	91
HMASS	Hub	366
SPMASS	Swashplate	139
TMASS	Transmission	2531
QM(1)-QM(20)	Blade distribution mass at each REXOR station	541-560

The center of gravity of the fuselage from the fuselage reference axis origin is specified by XFBAR, YFBAR, and ZFBAR. The hub center of gravity is assumed at the hub axis origin and no input is required. The swashplate center of gravity, ZGS, is the height of the swashplate center of gravity above the hub axis origin when the main rotor collective is at its trimmed value. The program computes the location of the blade masses as the blade bends and feathers. It assumes the blade masses are on the blade center-of-gravity axis defined with respect to the blade quarter chord axis. The location of the c.g. line was discussed earlier.

The transmission may be isolation mounted and modeled as a distinct dynamic mass. The transmission data is entered as a mass, TMASS, an inertia tensor and the mass center offset from the hub axes (XCGT, YCGT and ZCGT).

The moments and products of inertia required are presented in Table 41.

TABLE 41. - INERTIA AND C.G. DATA

Input Quantity		Address
XFBAR } YFBAR } ZFBAR }	Fuselage c.g. location relative to the fuselage axes	372 373 374
IXXF } IYYF } IZZF } IXYF } IXZF } IYZF }	Inertia terms for the fuselage wing and tail surfaces	1461 1462 1463 1464 1465 1466
IZZH	Hub	1468
IZZSP } IXXSP }	Swashplate	119 361
IXXENG	Engine (rotor drive only)	1471
IYYTR	Tail rotor	1472
BI	Blade moment of inertia about blade center of gravity axis. Inertia is distributed with per ft units at each REXOR station	561-580
ZSPZ	Distance of swashplate c.g. below hub axis for nominal collective	1469
IXXT } IYYT } IZZT } IXYT } IXZT } IYZT }	Inertia terms for the transmission	2535 2536 2537 2538 2539 2540
XCGT } YCGT } ZCGT }	Transmission c.g. location relative to the hub	2532 2533 2534

3.4.8 Airframe.

3.4.8.1 Geometry. - The geometry of the airframe includes the lengths to the various configuration fixed surfaces. The inputs involved are for the vertical tail (LVT, HVT), the lower horizontal tail (LHT), upper horizontal tail (LHTU) and dive brake (HDB). The wing quarter chord is assumed to intercept the fuselage vertical axis. See Table 42.

TABLE 42. - AIRFRAME GEOMETRY		
Input Quantity		Address
LHT	Distance from fuselage axis to lower horizontal tail, + aft	101
LVT	Distance from fuselage axis to vertical tail, + aft	102
HVT	Distance from fuselage axis to vertical tail, + up	103
LHTV	Distance from fuselage axis to upper horizontal tail, + aft	111
HDB	Height of dive brake center of pressure to fuselage axis	398

3.4.6.2 Aerodynamics. - The fuselage here is taken to include the wings, if any, plus vertical and horizontal tail surfaces. Ailerons, elevator, etc., are available. The aerodynamics are described by a table of values for the drag, lift and moment at all angles of attack and a matrix of derivatives expressing the sideslip characteristics and the damping due to the wing and tail surfaces. The aerodynamic formulation is given in Volume I, Section 6.4.

The static loads are given by RA(2601) = ALFA(1), RA(2621) = CL(1), (RA(2641) = CM(1), RA(2661) = CD(1) and following entries which relate the lift, drag and pitching moment coefficients to the angle of attack. A maximum of twenty angle-of-attack points are allowed which should cover the total range of values from -180 to +180 deg. These coefficients can be taken directly from wind tunnel tests of a model without the blades. The loads are sized by the wing area and the wing chord length, RA(2681) = AWING and RA(2682) = CWING. For a wingless configuration dummy values of 1.0 and 0.1 can be used. CWING should be small to reduce a wing damping term to a negligible size.

The data should preferably include the empennage contributions. However tail off data can be utilized by means of the TAILON flag RA(105) = 0., and some additional entries in Section 3.4.16.

The fuselage matrix RA(441) = FNM(1,1), RA(442) = FNM(2,1) and following entries allow for loads due to asymmetry, linear, and quadratic sideslip variations, wing damping in roll, plus vertical and horizontal tail damping. The matrix is a set of derivatives relating the fuselage forces and moments with the velocity terms. The first subscript in FNM refers to the loads and the second to the velocity. The terms are developed in Volume I, Section 6.4 and repeated here.

For tail on data the matrix has the form:

$$\begin{pmatrix} F_X \\ F_Y \\ F_Z \\ M_X \\ M_Y \\ M_Z \end{pmatrix}_{FW} = \begin{bmatrix} F_{FW}(1,1) & (1,2) & \dots & (1,7) \\ & (2,1) & & \\ & \cdot & & \\ & \cdot & & \\ & \cdot & & \\ & (6,1) & & (6,7) \end{bmatrix} \begin{pmatrix} u_F^2 \\ v_F^2 \\ |u_F| v_F \\ |u_F| p_F \\ |u_{HT}| \Delta w_{HT} \\ |u_{VT}| \Delta v_{HT} \\ |u_{HTV}| \Delta w_{HTV} \end{pmatrix}$$

For tail off data the Δ velocities are replaced by full values.

The loads are in wind axes, the velocities in fuselage reference axes. The X axis points forward, the Y rightward and the Z axis downwards. The first column represents loads due to airframe asymmetry such as those due to different incidence on the left and right wing panels. The second and third columns describe the static sideslip characteristics with both a linear and quadratic variation allowed where:

$$u_F v_F \cong u_F^2 \beta_F$$

and

$$v_F^2 \cong u_F^2 \beta_F^2$$

Assuming the matrix elements are found for moderate angles of sideslip β_F . The fourth column is zero unless the wing roll damping derivative $FIM(1,4)$ is significant. The fifth through seventh columns relate to the lift curves slopes $C_{L\alpha}$ and $C_{Y\alpha}$ of the horizontal and vertical tail surfaces such that

$$FIM(3,5) = -\frac{1}{2} \rho_o S_{HT} C_{L\alpha}$$

$$FIM(3,7) = -\frac{1}{2} \rho_o S_{HTV} C_{L\alpha}$$

and

$$FIM(2,6) = -\frac{1}{2} \rho_o S_{VT} C_{Y\beta}$$

where ρ_o is the sea level air density of 0.002378 slugs/ft³ (conventional units) and S is a tail surface area. The matrix elements are evaluated at sea level and the program ratios the fuselage aerodynamic load by the density ratio to altitude.

The pitching and rolling moment derivatives from the tail are obtained for the force derivatives times the appropriate tail length or height:

$$FNM(5,5) = \ell_{HT} * FFM(3,5)$$

$$FNM(5,7) = \ell_{HTU} * FFM(3,7)$$

$$FNM(4,6) = -h_{VT} * FFM(2,6)$$

and

$$FNM(6,6) = -\ell_{VT} * FFM(2,6)$$

The equation for FNM(4,6) is only a rough approximation to the tail fin dihedral effect. A variation with angle of attack is not allowed by the program.

The aerodynamic inputs required for the airframe are summarized in Table 43.

Incremental loads due to wing incidence, flaps, ailerons and dive brakes are also bookkept with the airframe aerodynamics. The flaps and wing incidence are inputted as partials of C_l , C_d , C_m . Ailerons are modeled as the "volume" of one aileron. The dive brake is modeled as the partial of flat plate area with respect to extension angle.

TABLE 43. - AIRFRAME AERODYNAMICS

Input Quantity		Address
TAILON	Airframe data flag, tail on = 1, off = 0	105
ALFA	Angle-of-attack table, deg	2601-2620
CL	Airframe C_L	2621-2640
CM	Airframe C_m	2641-2660
CD	Airframe C_d	2661-2680
AWING	Wing area, m^2 (ft^2)	2681
CWING	Wing chord, m (ft)	2682
PMN	Body airload coefficient matrix	441-432
PCLEFL	Airframe C_L due to flap extension	391
PCDFL	Airframe C_D due to flap extension	390
PCMFEL	Airframe C_M due to flap extension	392
PCIAW	Airframe C_L due to wing incidence change	394
PCDAW	Airframe C_D due to wing incidence change	393
PCMAW	Airframe C_M due to wing incidence change	395
PVAL	Control moment volume of one aileron	396
PSDA	Flat plate area increase due to dive brake angle	397

3.4.9 Tail rotor. - Aerodynamic and dimensional inputs are described here. Inertia, control and downwash data are described in other sections on the respective topic. The aerodynamic loads are presently formulated for use with a tail rotor whose upper blade moves aft. These data are summarized in Table 44.

TABLE 44. - TAIL ROTOR DATA		
Input Quantity		Address
SLTR	Distance from fuselage axis to tail rotor, + aft	98
HTR	Height of tail rotor above fuselage axis, + up	1348
YTR	Tail rotor lateral offset from fuselage axis, + RT	274
CONK	Tail rotor pitch-flap coupling, δ_3	1253
ACTR	Tail rotor blade area	2683
RTR	Tail rotor radius	2684
CLATR	Tail rotor lift slope, $dC_{L,}/d\alpha$	2685
B	Tail rotor tip loss factor	2686
STR	Tail rotor fin blockage factor	97
CDOTR	Tail rotor blade drag coefficient	99
FKTR	Drag coefficient rise as a function of average lift coefficient	100
LAMTR	Tail rotor shaft axis tilt right, deg	108
GRTR	Main rotor to tail rotor gear ratio	1475
ALTR	Tail rotor initial flap angle, rad	77

3.4.10 Thruster. - A set of auxiliary thrusting engines is modeled as a single composite powerplant in REXOR II. The unit is located a distance l_p aft of the fuselage reference and a height h_p above it. The thrust vector^p is inclined α_p radians above the fuselage X axis.

Thrust is modeled as partial derivative functions of Mach number and percent free turbine rpm which is treated as an input power lever. The thruster inputs are summarized in Table 45.

TABLE 45. - PROPULSION GROUP		
Input Quantity		Address
PTP1	Thrust as a function of power lever input squared, lbs per percent ² (typically)	1349
PTP2	Thru as a function of Mach number, N (lb)	1350
PTP3	Thrust as a function of the product of Mach number and power lever input (typically percent), N (lb)	1351
AIP	Thrust vector pitch elevation, deg	1352
HP	Thrust vector distance above fuselage axes	1353
LP	Thruster location aft of fus. axes	1354

3.4.11 Hub. - The mass properties are found in weight and balance, Section 3.4. The hub is located a distance $RA(96) = HF$ from the fuselage reference measured (+) down. It is at the point where the blade cone line intercepts the shaft.

3.4.12 Rotor drive group. - The inputs to be discussed relate to the shaft engine torque and the fuel control. This option is controlled by the rotor degree of freedom flag, NR, RA(15). The engine schematic is given in Volume I, Section 5.10, Figure 32.

Note the schematic gives engine speed, but for convenience the rotor speed is used as reference. The constants should be calculated with this in mind. The engine torque is bounded by zero and $RA(1484) = ENGHPR$. Drive train dynamics are not modeled. The engine inputs are summarized in Table 46.

TABLE 46. - SHAFT ENGINE INPUTS		
Input Quantity		Address
IXXENG	Spool moment of inertia	1471
PQENG	Torque to generator speed ratio, $\partial M_{ENG} / \partial \dot{\psi}_{GEN}$	591
PQEOM	Torque to rotor speed ratio, $\partial M_{ENG} / \partial \dot{\psi}_R$	592
K1PRM	Acceleration feedback gain, k_{R1}	593
K2PRM	Speed feedback gain, k_{R2}	594
TAUG	Gas generator time constant, τ_{GEN}	595
GRENG	Gear ratio engine	1474
GRTR	Gear ratio tail rotor	1475
ENGHPX	Maximum horsepower	1481
ENDMIZ	Trim torque	92

The engine and tail rotor gear ratios are needed GRENG, and GRTR. The gear ratios are positive if the rotors rotate as follows: main rotor, hub and swashplate are counterclockwise looking down, the engine is counterclockwise looking forward, and the tail rotor clockwise looking rightward.

3.4.13 Swashplate. - The swashplate programming is suitable for modeling two alternate control system types:

1. Locked swashplate degrees of freedom (1 to 3)
2. Normal swashplate

Table 47 lists the swashplate data required. The active swashplate degrees of freedom is controlled by NSP, RA(7). For NSP = 3, all degrees of freedom (roll, pitch and vertical) are active. For NSP = 2, the roll and pitch axes are active, and the collective motion is strictly a function of trim and pilot collective commands. When NSP = 1, the vertical motion is active, and the swashplate tilt equations are replaced by kinetic relations. The normal swashplate input spring rates, QKXCS and QKYCS, assume the meaning of radians swashplate deflection per unit of cyclic control deflection. Note these inputs are rotated through the swashplate to control axes phasing angle. Setting NSP = 0, gives kinematic relations for all three motions, and completely deletes the swashplate degrees of freedom.

The user is cautioned on numerical problems. In the case of a swashplate with stiff springs, the swashplate frequencies may be driven so high that numerical instabilities may occur. The locked swashplate may be preferred especially if the user is including only the three lowest blade modes and is not interested in pitch horn or torsion dynamics.

The user should be acquainted with Volume I, especially Sections 4.5.6, 4.5.7 and 5.9. Note the two axis systems: the swashplate axis and the swashplate control axis. The swashplate axes are aligned with the principal axis with the X roll axis forward, the Y pitch axis rightward and the Z heave axis downward. The control axis lags the swashplate axis by an azimuth CHI. Lag, the negative of lead, is taken positive in a direction opposite to rotor rotation where the advancing blade is on the right. The control loads will come from the pilot stick through the stick actuators, see Section 3.4.4, and act through the control springs with rates QKXCS and QKYCS.

In the FLY mode the cyclic stick inputs from the combined pilot input (Section 3.4.4) and trim values (Sections 3.4.3 and 3.4.14) are processed through a first order lag and rate limiting prior to being applied to the swashplate input spring rates QKXCS and QKYCS. Note that the input and intermediate units are completely flexible, and user controlled via input to the control scaling factors (Section 3.4.14) and input spring units. Typically the cyclic controls are expressed in percent of full scale, the scaling factors convert these numbers to feet and the spring rates convert these to foot pounds. However the whole system could be operated as metric deflections and torques (SI units). Whatever system is used the rate limiter numbers must be expressed in the units of cyclic input to the swashplate springs.

TABLE 47. - SWASHPLATE INPUTS			
Input Quantity			Address
Swashplate to Feathering Geometry			
ψ_{PH}	BETAG	Pitch horn lead azimuth	125
e	E	Pitch horn arm	136
$(d/e)_0$	DOEO	Ratio of cyclic feathering to swashplate angle at zero collective	271
$(d/e)_1$	DOE1	Variation of $(d/e)_0$ with collective	272
ψ_C	CHI	Azimuth swashplate leads control axis	119
K_{XCS}	QKXCS	Swashplate roll control spring rate, control axis	123
K_{YCS}	QKYCS	Swashplate pitch control spring rate, control axis	124
Springs, Dampers, Friction and Slop			
$K_{\phi SP}$	KPHCON	Swashplate roll spring rate in control axis	376
$K_{\theta SP}$	HCON	Swashplate pitch spring rate in control axis	377
$C_{\phi SP}$	CPHCON	Swashplate roll damper rate in control axis	378
$C_{\theta SP}$	CTHCON	Swashplate pitch damper rate in control axis	379
$\delta_{S,SP}$	GASTOP	Swashplate stop contact angle	1276
$K_{S,C.}$	GKSTOP	Swashplate stop spring rate	1277

TABLE 47. - SWASHPLATE INPUTS (Concluded)			
Input Quantity			Address
Springs, Dampers, Friction and Slop (Continued)			
$\dot{\phi}_{SP, BK}$ $\dot{\theta}_{SP, BK}$	RLG	Swashplate friction break point	116
$M_{FR, \phi_{SP}}$ $M_{FR, \theta_{SP}}$	FCG	Swashplate friction at break point	117
Vertical Motions			
$K_{1Z_{SP}}$	QKGZ1	Swashplate vertical spring rate at low deflections	137
Z_{1SP}	ZG1	Swashplate vertical spring breakpoint	141
$K_{2Z_{SP}}$	QKGZ2	Swashplate vertical spring rate at high deflection	140
F_C	FIDDLE	Swashplate vertical spring centering force	1494
C_{ZSP}	QCGZ	Swashplate vertical damping rate	138
$R_{Z\phi}, R_{Z\theta}$	DGDHG	Swashplate rotary to vertical damping coupling	1263
Input Actuators			
	TAUXC	Longitudinal cyclic first order lag time constant, sec.	292
	TAUYC	Lateral cyclic first order lag time constant, sec.	293
	RATLXC	Longitudinal cyclic stick input rate limiter, units/sec.	437
	RATLYC	Lateral cyclic stick input rate limiter, units/sec.	438

BETAG and E describe the pitch horn cant angle and arm length, see Figure 9.

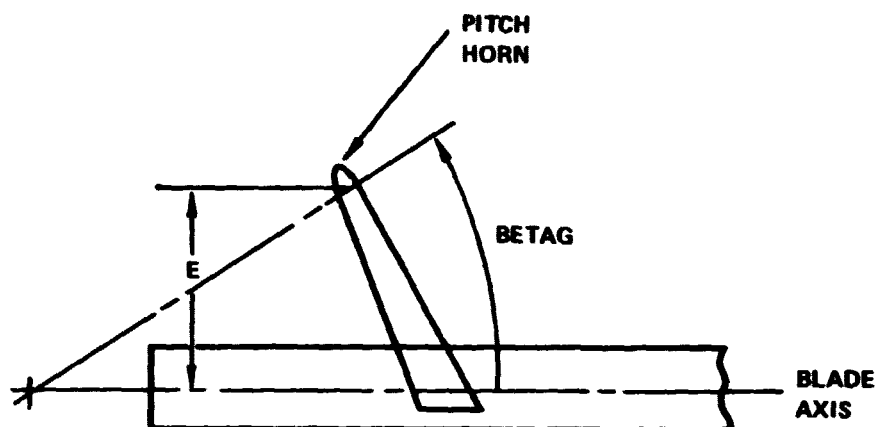


Figure 9. Pitch Horn Geometry

If the pitch horn is behind the blade, instead of leading like the figure, E is negative and BETAG is π radians minus the physical angle.

Suspension springs, and if installed the dampers, are modeled with rates KPHCON, ..., CTHCON. These are established in swashplate control axis. Therefore, terms which would couple pitching loads to roll deflections and vice-versa do not exist. Note the suspension springs are defined with the controls blocked, and the control springs with the swashplate blocked.

Swashplate stop springs are modeled. They are circular in the sense that the stop spring rate is the same in any direction. Friction is also the same in any direction. It follows the function illustrated in Volume I, Figure 30. Pure viscous friction is obtained by making RLG very large and the ratio FCG/RLG equal to the viscous friction coefficient in ft-lb/rad. A moderate value of RLG sets a rate beyond which the friction is limited to the stiction value FCG. A tiny RLG value (not zero) obtains pure stiction for all practical purposes.

Most of the swashplate collective inputs are self-explanatory. FIDDLE supplies a means for "centering" the low spring rate portion of the swashplate travel. DGDHG is a cyclic to collective damper coupling factor. The swashplate cyclic dampers produce a collective force proportional to the swashplate deflection and the cyclic damper load. See Volume I, Section 5.9.3 for equations.

When the user operates the program with the swashplate locked only six inputs as listed in Table 48 need be considered. If the actual swashplate deflections are immaterial, the user may find nominal values of

DOEO = 1, DOE1 = 0 and BETAG = 0 convenient. Then if CHI = 0 an aft stick will gear the swashplate to roll right through the gear ratio. In turn the swashplate deflection will cause an equal amount of pure longitudinal cyclic to appear. The overall equation is

$$\begin{pmatrix} A_{1S} \\ B_{1S} \end{pmatrix} = \left(\left(\frac{d}{e} \right)_0 + \left(\frac{d}{e} \right)_1 \theta_0 \right) \begin{bmatrix} \sin \psi_{PH} & \cos \psi_{PH} \\ \cos \psi_{PH} & -\sin \psi_{PH} \end{bmatrix} \begin{bmatrix} \cos \psi_C & -\sin \psi_C \\ \sin \psi_C & \cos \psi_C \end{bmatrix} \begin{pmatrix} -K_{XC} X_C \\ K_{YC} Y_C \end{pmatrix}$$

which can be derived from Volume I, Sections 4.5, 5.9.3 and 5.9.4 where K_{XC} and K_{YC} are interpreted as gear ratios rather than spring rates.

TABLE 48. - CONTROL INPUT FOR LOCKED SWASHPLATE			
Input Quantity			Address
K_{XC}	QKXCS	Ratio swashplate control roll to longitudinal stick deflect	123
K_{YC}	QKYCS	Ratio swashplate control pitch to lateral stick deflection	124
ψ_C	CHI	Azimuth swashplate axis leads control axis	119
$(d/e)_0$	DOEC	Ratio cyclic feathering to swashplate angle at zero collective	271
$(d/e)_1$	DOE1	Variation of $(d/e)_0$ with collective	272
ψ_{PH}	BETAG	Pitch horn lead azimuth	125

3.4.14 Control system. - REXOR II models a control system that contains all the elements of a typical helicopter plus controls normally found on fixed-wing aircraft. All these elements are operated from one set of pilot controls.

A set of scaling factors is provided so that the control settings may be expressed in units independent of the units used internally to deflection angles, etc. It is suggested that the pilot inputs be expressed as percent of limit travel and the scaling factors be used accordingly. These factors are given in Table 49.

TABLE 49. CONTROL SCALE FACTORS		
Input Quantity		Address
KXCSFS	Longitudinal stick units input to feet scaling factor	1933
KYCSFS	Lateral stick units input to feet scaling factor	1984
KELFS	Elevator units input to radians scaling factor	1985
KAILFS	Aileron units input to radians scaling factor	1986
KTRFS	Tail rotor units input to radians scaling factor	1987
KRUDFS	Rudder units input to radians scaling factor	1988
KTHFS	Collective units input to radians scaling factor	1990
KDBFS	Dive brakes units input to radians scaling factor	1991
KFLFS	Flap units input to radians scaling factor	1992
KJWFS	Wing incidence units input to radians scaling factor	1993
KIHTFS	Tail incidence units input to radians scaling factor	1994

The helicopter and fixed-wing controls are partially interconnected. The longitudinal stick operates both the longitudinal stick helicopter input and the elevator. Similarly the lateral input operates the lateral stick helicopter input and the ailerons. The rudder input operates the tail rotor collective and the rudder. A set of multipliers, termed phasing gains, is provided to apportion the longitudinal pilot input between helicopter and fixed-wing controls. See Table 50. These factors vary between 0.0 and 1.0. It is possible then with a fully defined control set to vary the control characteristics from helicopter to airplane with these five coefficients.

TABLE 50. - PHASING GAINS		
Input Quantity		Address
GAINC	Helicopter cyclic system input from cyclic stick	86
GAINEL	Elevator input from cyclic stick	87
GAINAL	Aileron input from cyclic stick	89
GAINTR	Tail rotor input from pedals	88
GAINRD	Rudder input from pedals	90

Control rigging offsets and cross couplings are also modeled. The rigging offsets account for tail rotor right thrust with neutral pedals, etc. The cross coupling partial derivatives model cyclic and tail rotor collective inputs as a function of collective position. These couplings may be deliberate control compensations or the result of system characteristics. The inputs are given in Table 51.

TABLE 51. - CONTROL RIGGING		
Input Quantity		Address
DELO	Elevator up deflection for zero input, rad	32
DAILO	Aileron up deflection (right) for zero input, rad	33
THETRO	Tail rotor collective for neutral pedals, rad	34
DRUDO	Rudder right deflection for neutral pedals, rad.	35
PXPT	Aft longitudinal stick, m (ft) for radians collective	74
PYPT	Right lateral stick, m (ft) for radians collective	75
PTPT	Radians tail rotor collec- tive for radians collective	76

Six SAS channels are provided in REXOR II. These are for lateral and longitudinal cyclic, elevators, ailerons, tail rotor, and rudder. All channels are identical in modeling. Each has two inputs. One input is processed through a washout and gain whereas the other input has an additional first order lag stage. See Figure 10. Output limiting is provided. The gains should be selected so that the internal signal levels in each SAS channel are on the same basis as the control each is connected to, i.e., if the lateral stick input will be expressed in percent, then the internal levels of the lateral stick channel should also be in percent. The output gains of each SAS channel will be the same as the respective scaling factor associated with pilot and trim inputs. The inputs are given in Table 52.

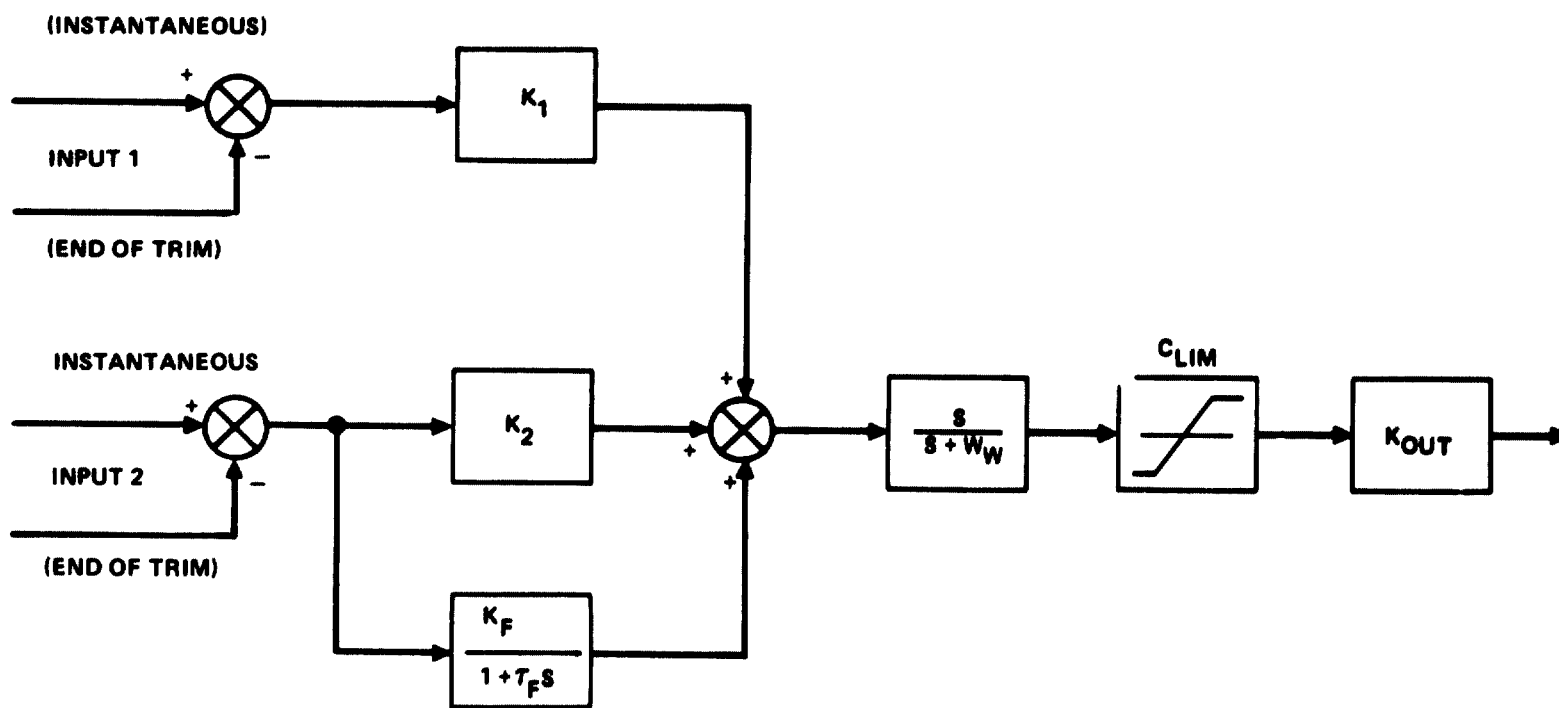


Figure 10. - Typical SAS channel.

TABLE 52. - SAS INPUTS

Input Quantity		Address
SASDX:	(Longitudinal Stick) Input 1 Fuselage roll rate Input 2 Fuselage pitch rate	
	(1) K_1 Gain Input 1	1941
	(2) K_2 Gain Input 2	1942
	(3) K_F Gain first order lag	1943
	(4) W Washout frequency	1944
	(5) K_{OUT} Output gain	1945
	(6) τ Lag time constant	1946
	(7) C_{LIM} Output limiter	1947
SASDY:	(Lateral Stick) Input 1 Fuselage yaw rate Input 2 Fuselage roll rate	1948-1954
SASDEL:	(Elevator) Input 1 Fuselage roll rate Input 2 Fuselage pitch rate	1955-1961
SASDAL:	(Aileron) Input 1 Fuselage yaw rate Input 2 Fuselage roll rate	1962-1968
SASDTR:	(Tail Rotor) Input 1 Fuselage roll rate Input 2 Fuselage yaw rate	1969-1975
SASDRD:	(Rudder) Input 1 Fuselage roll rate Input 2 Fuselage yaw rate	1976-1982

3.4.15 Shaft degrees of freedom - transmission mount. - REXOR II allocates up to six degrees of freedom to model a passive transmission vibration isolation mount. These degrees of freedom allow three translational and three rotational motions of the transmission, hub, and rotor assembly with respect to the fuselage. The control system remains referenced to the hub coordinates.

The shaft degrees of freedom can be individually selected by the flags IS1 to IS6. See Table 53. The fuselage to transmission mount distances are set by the triad DZFMB, and the X, Y, Z dimension from the transmission mount to the hub axes by DZMBH. To accommodate rotor tilt, a set of delta Euler angles ϕ_{OS} , θ_{OS} , ψ_{OS} are provided. These angles are added to the deflections due to the shaft generalized coordinates, but do not produce generalized forces.

The transmission sits on a spring-damper mount which is described to the program by the arrays SHAFTK (springs) and SHAFTC (dampers).

TABLE 53. - TRANSMISSION MOUNT DATA			
Input Quantity			Address
IS1	X	} shaft degree of freedom flags = 1. active; = 0. locked out	9
IS2	Y		10
IS3	Z		11
IS4	ϕ		12
IS5	θ		13
IS6	ψ		14
DZFMB:	Fuselage to mount distances, m (ft)		
(1)	X		491
(2)	Y		492
(3)	Z (+) down		493
DZMBH:	Transmission mount to hub distances, ft		
(1)	X		494
(2)	Y		495
(3)	Z (+) down		496
PHIZS	Roll	} shaft offset angles w.r.t fuselage axes, deg	2561
THIZS	Pitch		2562
PHIZS	Yaw		2563
SHAFTK(6,6)	Transmission mount spring matrix, N/m (lb/ft) and N-m/r (ft-lb/rad) (rotational modes)		401-436
SHAFTC(6,6)	Damper matrix, N/m/s (lb/ft/sec) and N-m/r/s (ft-lb/rad/sec)		2831-2866

3.4.16 Induced flow. - The effect of main rotor downwash on the fuselage-wing combination and on the horizontal tails is presented to the program in the form of interference factors. These interference factors are tabular functions of wake angle.

The wake angle is zero in hover, 90 deg at extreme forward flight speeds, and -90 deg at extreme rearward speeds. The table should have all values from +180 to -180 deg. Values less than -90 deg or greater than 90 deg mean the induced airflow is upward through the rotor disk due to an unusually high rate of descent or negative rotor lift in severe maneuvers.

Two tables are identified with a doubly dimensioned array with the main rotor to wing function beginning at FXTN(1,1) and the main rotor to lower horizontal tail function beginning at FXTN(1,2). The upper horizontal tail function is identified as FXTU(I). The functions will be linearly interpolated. The format is demonstrated in Table 54.

TABLE 54. - WAKE ANGLE FUNCTION	
Main rotor to wing function	
FXTN(1,1)	= N, (number of point pairs)
FXTN(2,1)	= $\chi_u, 1$
FXTN(3,1)	= F, 1
FXTN(4,1)	= $\chi_u, 2$
FXTN(5,1)	= $F_\chi, 2$
.	
.	
.	
FXTN(2N, 1)	= χ_u, N
FXTN(2N + 1, 1)	= F_χ, N
(Maximum number of data pairs is 12)	
Main rotor to lower horizontal tail function	
FXTN(1,2)	= (number of point pairs)
.	
.	
.	
Main rotor to upper horizontal tail function	
FXTU(1)	= (number of point pairs)

The wing-fuselage combination produces wake effects on both horizontal tails. These effects are modeled as $\partial\epsilon/\partial\alpha$, or radians of downwash at the tail locations per radian of freestream angle of attack.

An analogous effect is sidewash on the vertical tail and tail rotor due to sideslip. Partial derivatives of the form $\partial\sigma/\partial\beta$ are input for the vertical tail and tail rotor.

Wake deficiency factors are modeled to give the reduction in freestream velocity at the horizontal and vertical tails and tail rotor.

If tail off aerodynamic data is specified, then overall initial downwash efficiency factors ϵ_0 are required for the lower and upper horizontal tails. The initial sidewash number for the vertical tail is computed from the associated partial derivative in the program.

The downwash efficiencies are also a function of the wing incidence change and flap deployment if the modeled configuration is so equipped. These effects are modeled by the partial derivatives $\partial\epsilon/\partial i_w$ and $\partial\epsilon/\partial\delta_{FL}$.

A series of velocity efficiency factors are modeled to account for control surface motions and incidence change. These are for horizontal tail incidence, $\tau_{i_{HT}}$, elevator motion, τ_{SEL} , and rudder motion τ_{SRUD} . These inputs are tabulated in Table 55.

TABLE 55. - INDUCED FLOW INPUTS		
Input Quantity		Address
FXTN(1,1)	Main rotor to fuselage-wing interference factor table	1751-1775
FXTN(1,2)	Main rotor to lower horizontal tail interference factor table	1776-1880
FXTU(1)	Main rotor to upper horizontal tail interference factor table	1201-1225
DEODA	Wing wake factor at lower horizontal tail, $(\partial\epsilon/\partial\alpha)_{HT}$	135
PEHA	Wing wake factor at upper horizontal tail, $(\partial\epsilon/\partial\alpha)_{HTU}$	383
PSVTB	Fuselage sidewash wake at vertical tail, $(\partial\sigma/\partial\beta)_{VT}$	386
PSTRB	Fuselage sidewash wake at tail rotor, $(\partial\sigma/\partial\beta)_{TR}$	107

TABLE 55. - Continued

Input Quantity		Address
ETAE	Equivalent velocity ratio at the tail rotor	106
ETAVT	Equivalent velocity ratio at the vertical tail	120
ETAHT	Equivalent velocity ratio at the lower horizontal tail	121
ETAHTU	Equivalent velocity ratio at the upper horizontal tail	122
EOHT	Initial downwash efficiency factor on the lower horizontal tail, ϵ_{OHT}	94
EOHTU	Initial downwash efficiency factor on the upper horizontal tail, ϵ_{OHTU}	95
PEHIW	Downwash efficiency partial due to wing incidence for lower horizontal tail, $(\partial\epsilon/\partial i_w)_{HT}$	382
PEHTIW	Downwash efficiency partial due to wing incidence for upper horizontal tail, $(\partial\epsilon/\partial i_w)_{HTU}$	385
PEHFL	Downwash efficiency partial due to flap extension for lower horizontal tail, $(\partial\epsilon/\partial\delta_{FL})_{HT}$	381
PEHTFL	Downwash efficiency partial due to flap extension for upper horizontal tail, $(\partial\epsilon/\partial\delta_{FL})_{HTU}$	384
TAUHT	Horizontal tail incidence velocity efficiency partial, $\partial\tau/\partial i_{HT}$	389
TAUEL	Horizontal tail elevator velocity efficiency partial, $\partial\tau/\partial\delta_{EL}$	388
TAURUD	Vertical tail rudder velocity efficiency partial $\partial\tau/\partial\delta_{RUD}$	387

3.4.17 Blade jettison simulation. - A main rotor blade jettison simulation can be activated. This operation is restricted to a 5-bladed system with a specific jettison sequence.

Operationally, the blade-jettison sequence is activated at a prescribed rotor cycle measured from trim. This cycle is input in JETCTC (RA 64). When activated, main rotor blades 1, 3, and 4 are removed from the generalized coordinate set. The number of blades, NB, is reduced to two. At a prescribed number of integration steps later, $\eta = NAZ/5$, the remaining blades are jettisoned. At that time, quasi - static pitch horn and quasi-static torsion will be turned off. Also, all swashplate coordinates will be turned off.

The user is reminded that some auxiliary outputs are a function of blade 1 data. During a jettison sequence, "blade 1" data are redefined. Thus, mixed data will be processed in the signal set.

4. PLANNING AND OPERATING THE PROGRAM

4.1 Run Time Required

REXOR II is a complex program and run time costs are considerable. The pressures to get a job done often precludes proper attention to computer time savings. Nonetheless, a portion of the user's time should be made available for carefully checking the runs already completed, checking the inputs for the runs to be made and in planning the scope of the project to begin with.

Direct control over run time is obtained with $RA(36) = TCUT$ which limits the number of rotor revolutions in TRIM and $RA(1498) = TSTOP$ which limits the time in FLY. Cases should be rare where TCUT exceeds 24 cycles and TSTOP exceeds 8 seconds. These values should be examined for every new series of cases to see if they can be reduced.

The program usually meets the trim criteria before the number of rotor revolutions reaches TCUT. The run should not be rejected out of hand for trim failures as the trim criteria for the controls are fairly severe. Plot traces have a typically exponential character and the user can readily see about how close to trim the case is. A 0.1 degree error in cyclic main rotor angles, say, is certainly not cause for rejection for a lot of cases.

Direct control is also available on the number of time points computed per rotor revolution, $RA(51) = NAZ$. The value is dependent on whether high-frequency modes are operative or not. Serious consideration should be given to operating the program with as few degrees of freedom as is reasonable.

REXOR II has been run for minimal degrees of freedom with NAZ as low as 24. Normally, though, NAZ is more like 120, 180, or 240, and sometimes even 360 to provide numerical stability. In computing the AH-56A Cheyenne inplane stability, damping resolution of the order of 1/10 of the structural damping was experienced providing the azimuth interval was small enough to preclude numerical instability.

Summarizing, run times can be computed based on REXOR II input values. The run time per case, where a case is defined in Section 3.1 is computed

$$t_c = (t_{TRIM} + t_{FLY})/60, \text{ units of minutes/case}$$

where

$$t_{TRIM} = (k)(NAZ)(TCUT)$$

$$t_{FLY} = (k)(NAZ)(\Omega)(TSTOP)/2\pi$$

and

$$\Omega = RA(52)$$

The other addresses are defined above. The parameter (k) has units of sec/azimuth, and can be determined by measuring a computer run. The data in Table 56 is offered as a reference.

TABLE 56. - MACHINE TIME ESTIMATES		
Machine	k.	
	No dynamic stall	With dynamic stall
IBM 360/91	0.16	0.18
CDC 6600	0.48	0.54
IBM 360/65	1.12	1.26

The 360/91 values are accurate for 13 blade stations. Values for the other machines are estimates. It should be noted that the above values are based on a four-bladed rotor system.

The user is advised to proceed slowly in submitting cases. Look over the output of the last case carefully. The idea is to double check the inputs, to spot and remove errors. Having a series of runs bomb just because one little input was wrong or missing is expensive.

4.2 Trim Saving Procedures

Trim save cards can be obtained by actuating the RA(47) = IPUNCH flag and this is highly recommended even if the next case varies considerable from the flight conditions of the trim save case. Some of the trim save inputs can be filled out by hand and will aid trim. Of first importance are the downwash of the main rotor and the tail rotor, RA(65) = WIMR and RA(77) = WITR. Other quantities which may be initialized to aid in reaching final trim values are RA(53), RA(54), RA(55), RA(56), RA(57), RA(58), RA(59) and RA(63) if they are among the set of trim variables selected by the trim option. There are other factors discussed in detail in Section 3.4.3.

4.3 Troubleshooting

Troubleshooting here shall be limited in discussion to the effort required to fly a new helicopter configuration in the program where only relatively simple program changes are required. The effort required to check out a major change of the program that affects the primary degrees of freedom is at least an order of magnitude greater than that required to check out new input data.

Checkout of the program should proceed by repeating a known case and is aided by correlating with any available test data, such as whirl tower or tie-down tests. Lacking test data, simpler analyses can sometimes be used in limited comparisons of performance and handling qualities. In areas where tests data or simpler analyses are not available, the user must use great care in evaluating the inputs and in determining the reasonableness of the output results. All the output should be carefully examined and new output programmed if doubts can not be clarified. Sometimes special check can be devised such as fixing a roll rate on the rotor and observing the value of the required pitch processional moment, or observing the flap displacement and root blade moment obtained with an increment in the feather angle, etc.

The steps required to get a new configuration up and running can be serialized as follows:

1. Gathering of data. The user must obtain all details on the configuration especially in regard to blade sweep, blade droop, blade jogs, feather bearing cone angles, pitch horn stiffness, blade inertial and modal data, pitch-flap-lag couplings, swashplate stiffness, and shaft flexibility. The stability of the rotor modes are often highly dependent on the values of these inputs.
2. Write up and implement program modifications. Here only simple modifications are assumed which are almost inescapable for a new configuration. One needs to be more careful with changes that affect the physical model being represented through the equations of motion compared to changes in say, the output-input format.
3. Decide what degrees of freedom can be removed. The characteristic frequency of the torsion or the swashplate may be too high to be significant. The engine degree of freedom usually can be turned off except for autorotation or extreme maneuvers. A fixed shaft study involving the blades and the swashplate degrees of freedom only may be appropriate. Another strategy that can be employed is to turn all possible degrees of freedom off to begin with to simplify the checkout, then add shaft bending, etc., and recheck the output.

4. Compute one pass of the program. Here the simple errors which lead to zero divide, no initialization, etc., will be apparent. This stage is complete when the tabulation for the first time point appears. The tabulation of the inputs include a card listing and then a relisting of input in like groupings. The inputs are rechecked using the like-grouping format which may make it easier to spot wrong numbers. Also at this time the statements for program changes are reviewed for correctness.
5. The next stage occurs when a portion of the TRIM time history is obtained. Check all quantities in the tabulation of the first time point against the inputs for reasonableness; also check for signs, zeros and the absence of huge numbers. Examine the time histories to see that all quantities have started off properly. If a rapid divergence or oscillation has occurred, numerical instabilities are to be suspected; a low rate could mean the trim gains are too low. A good value is one that causes a pure, rapid convergence without overshoot oscillations or indications the trim variable is following vibratory loads. Numerical instabilities may be cured by using a smaller increment between time points. A rapid divergence may, however, be a simple input error in the spring rate, etc.
6. Next, a portion of the FLY time history will run. Check the TRIM time histories to see the trim variables plots are almost horizontal near the end of TRIM indicating a true TRIM condition has been closely approached. In FLY numerical difficulties may again occur. Check the tabulation at the end of TRIM and the beginning of FLY for reasonableness of values. A point is finally reached when the FLY plots appear reasonable, that the system is stable without any control input (or if not, should be expected) and that the system moves in the proper direction and with about the expected magnitude upon application of a control input. A good rule is to apply no input for the first half or full second of FLY. This procedure helps determine the quality of TRIM and provides a reference level for the control input to follow. Difficulties can be evident which may only be due to an unsatisfactory design. Careful attention would be paid to the inplane mode stability in its collective, cyclic or reactionless manifestations. Parameter sensitivity studies may be in order or perhaps more flight conditions should be investigated.

A few messages are printed, some relating to bomb flags. These flags are not intended to be an error detection system. Also the location from within the program where they originate is not indicated.

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There are a few large number detectors which stop the case when they are exceeded. Included are excessive values for the trim variables, for root blade loads, and blade deflections. The intention is to detect a divergence from within the program before a computer overflow occurs. Then, the time history plots with automatic scaling based on the largest values will be useful. Without bomb tests, a computer overflow number like 10^{77} will cause all plot data to look like zero except for the last point.

5. TABULATED OUTPUT

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An example of tabulated data is presented in Table 57. The first block of printout is a complete list of the input data deck as submitted. A card column count header is presented for checking. This form of output is helpful in determining input card image errors. This block is followed by a formatted listing of the same input data. Master data are assembled and printed in cataloged forms. Single address inputs are identified and listed numerically. Tabular data is presented in table form for better readability. Case data follows the master data, and is presented as an exception report. Case data is identified as "LIST OF CHANGES TO MASTER DATA". Optional printout now follows with the SWEEP diagnostic output discussed in Section 3.4.5.5. The optional mass matrix print follows as also given in Section 3.4.5.5. The end of a successful run is indicated by the comment "THE CASE IS COMPLETED". The total trajectory run time is indicated. This comment is followed by the indicated length of TRIM. Three other pieces of information are provided. First is the number of points saved in the signal set as the save frequency. Then the blocked time history output follows. Finally, optional harmonic output is printed.

TABLE 57. - SAMPLE REXOR TAB OUTPUT

INPUT DATA

C43D CULUMIS 123456789012345678901234567890123456789012345678901234567890

MASTER DATA		CREATED	L4-27-77					
DOCT		HELICOPTER	DEMONSTRATION	CASE				
1	5	5.0	1.0		1.0	1.0		
7	11	5.0	0.0	1.0	1.0	1.0		
17	14	1.0	1.0	1.0				
34		5.73						
35		15.0						
46		1.0						
49	49	1.0	1.0					
51	55	24.0	21.29	0.0	-5	-4		
56		61.0						
58	59	-5	0.0					
62		71.0						
64		10						
72		11.0						
74		31.0						
84		-5.0						
95		1.0						
97		1.0						
99		533						
99	99	1000.0						
100	103	1.1	-5.50	.88	34.6	.0058		
100	110	1.1	0.0	38.3	4.3			
100	110	1.07	.5	0.0	.002378	1.52		
111		-5.5						
114		100.0						
117		100.0						
118		3.0						
120		1.42						
122	124	1.0	6754	6641				
122	129	1.542	.5417					
126	140	.667	25.00	50	1.7	29003		
141		5.0						
143	144	1.0	-1.0					
150		15.0						
151	155	0.0	.2	.4	.8	.8		
156	150	1.0	1.2	1.4	1.6	1.8		
161	165	2	2.2	2.4	2.6	2.8		
177	179	20	20					
190	190	30	30	-30	-30			
200	221	10	10					
240	243	0	-2					
271		1.07						
274		-2.0						
275	276	0.1616	-0.3203E-04	.03403	-0.6924E-04			
279	282	-0.3689E-04	.01549	-0.7769E-04	.03366			
283	286	-0.7715E-04	-0.01100	-0.01624	-0.06543			
297	296	1.0	.05	.1				
299	293	.025	.025					
299	294	22.25	1.0					
303		-30.174						
304		1.0						
305	307	24.7	.0331					
370	374	10700	.000	.75	0.0	-5		
376	387	10700	10000	50	50	.97		

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TABLE 57. - Continued

INPUT DATA
CARD COLUMNS 123456789012345678901234567890123456789012345678901234567890

383	.12					00000560
384 267	.5					00000570
397 368	16.3	.25				00000580
401	500000.	-3.5				00000590
404	500000.					00000600
413	100000.					00000610
422	500000.					00000620
429	500000.					00000630
436	500000.					00000640
437 439	1.67	1.67	.13			00000650
448	-.31					00000660
454	-.21					00000670
456 458	.17	0.0	-2.43			00000680
472 476	-.24	0.0	-1.0	0.0	9.2	00000690
479 481	-.185	0.0	-4.8			00000700
497	-4.08					00000710
497	-.5					00000720
501 505	11250.	5000.	1.0	3.3	0.75	00000730
1250 1252	.50057	.00057	.00057			00000740
1253	1.0					00000750
1276	1.0					00000760
1281	1117.					00000770
1343	4.5					00000780
1481 1485	0.00.	97.00.	90000.	0.0	4300.	00000790
1483 1489	100.	1.5				00000800
1471 1475	50.	7.0	0.0	93.2	6.12	00000810
1487	3.0					00000820
1711 1755	5.0	-100.	0.0	0.0	1.0	00000830
1715 1760	9.0	1.0	100.	0.0		00000840
1083 1084	.00417	.00417				00000850
1087 1089	.00436	.00523	.00279			00000860
1091	.0101					00000870
2531	125.					00000880
2035 2537	250.	250.	500.			00000890
2540	.5					00000900
2561 2562	-.5	-5.				00000910
2601 2605	-100.	-167.	-90.	-30.	-25.	00000920
2616 2619	-20.	-15.	-10.	-5.	0.0	00000930
2611 2615	5.	10.	15.	20.	25.	00000940
2616 2619	20.	90.	167.	150.		00000950
2621 2625	0.0	17.	0.0	-15.	-15.	00000960
2626 2630	-13.5	-9.4	-5.7	-2.	1.7	00000970
2631 2635	5.0	8.4	11.0	15.3	18.1	00000980
2636 2639	17.8	0.0	-17.	0.0		00000990
2644 2648	-349.	-400.	-470.	-360.	-280.	00001000
2649 2653	-175.	-70.	40.	150.	270.	00001010
2654 2658	340.	490.	530.			00001020
2661 2665	13.7	16.9	324.	24.	20.5	00001030
2666 2670	17.6	15.4	13.8	13.7	14.2	00001040
2671 2675	15.5	16.5	18.5	21.2	25.	00001050
2676 2679	25.	324.	16.4	13.7		00001060
2681 2685	1.0	1.0	16.28	5.32	9.75	00001070
2686	.92					00001080
2689	.01					00001090
2695	1022.					00001100

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TABLE 57. - Continued

INPUT DATA
CARD COLUMNS 123456789012345678901234567890123456789012345678901234567890

94	.02						00001660
101	29.79						00001670
107	.44						00001680
120 121	.07	.96					00001690
135	.11						00001700
174	.11						00001710
181 305	.15	.2	.6	.37	.5		00001720
305	.44						00001730
316 392	.1	1.	60.	428.	-145.		00001740
394 396	184.	-447.	1733.				00001750
404	-1.33						00001760
405	.40						00001770
440	-1.44						00001780
450	-1.07.						00001790
467	-1.08						00001800
469	-20.3						00001810
180	10.						00001820
181 185	.1	.2	.4	.6	.8		00001830
184 185	1.	1.3	1.6	1.8	2.		00001840
177 179	0.5	0.6					00001850
205 221	0.6	0.6					00001860
163 244	0.6	0.6					00001870
257	0.						00001880
507	17.1.						00001890
12 1105	10.	-100.	0.	0.	.1		00001900
12051211	0.	.7	100.	2.	180.		00001910
1712	0.5						00001920
13011302	12.						00001930
13111302	.02	1.					00001940
13511332	-10006	.2					00001950
13401353	1.44	-8000.	-48.	-3.5	.5		00001960
1374	0.						00001970
16011405	00000.	100000.	116000.	0.0	1500.		00001980
140	1.2						00001990
17751780	0.	-180.	0.0	0.0	1.8		00002000
17011784	0.	1.4	100.	0.0			00002010
19401245	-0.	-150.	.1	.07417	5.		00002020
1947	1.						00002030
17411057	-80.	-150.					00002040
19401954	000417	5.	10.				00002050
19751974	-80.	-150.	.1	.00436	3.		00002060
1974	12.						00002070
19851986	000523	.001745					00002080
199	1.						00002090
19901994	000523	.001262	.001396				00002100
2012003	-130.	-167.	-90.	-40.	-20.		00002110
20002010	-16.	-12.	-8.	-4.	0.		00002120
20112015	4.	0.	12.	16.	20.		00002130
20102019	4.	90.	167.	180.			00002140
20212023	0.0	280.	0.0	-193.	283.		00002150
20202031	-265.	-217.	-131.	-24.	76.		00002160
20312034	100.	300.	367.	400.	418.		00002170
20302037	0.	0.0	-280.	0.0			00002180
20412040	0.	0.0	0.0	-2.3	-42.		00002190
20402050	-2.6	-51.9	-54.3	-51.3	-31.6		00002200

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TABLE 57. - Continued

RECORDED 11 (MARCH 73)

CASE DEMO-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

MASTER DATA

1 1A	1.000E 00	2 141	1.000E 00	3 142	1.000E 00	4 143	1.000E 00	5 144	1.000E 00
6 145	0.0	7 146	0.000E 00	8 147	0.000E 00	9 148	1.000E 00	10 149	1.000E 00
11 150	1.000E 00	12 151	1.000E 00	13 152	1.000E 00	14 153	1.000E 00	15 154	0.0
16 155	0.0	17 156	0.0	18 157	0.0	19 158	0.0	20 159	0.0
21 160	0.0	22 161	0.0	23 162	0.0	24 163	0.0	25 164	0.0
26 165	0.0	27 166	0.0	28 167	0.0	29 168	0.0	30 169	0.0
31 170	0.0	32 171	0.0	33 172	0.0	34 173	0.0	35 174	0.0
36 175	1.000E 01	37 176	0.000E 00	38 177	0.0	39 178	0.0	40 179	0.0
41 180	0.0	42 181	0.0	43 182	0.0	44 183	0.0	45 184	0.0
46 185	1.000E 01	47 186	0.0	48 187	1.000E 00	49 188	1.000E 00	50 189	0.0
51 190	0.000E 02	52 191	0.000E 01	53 192	0.0	54 193	-5.000E-01	55 194	-4.000E 00
56 195	0.0	57 196	0.000E 01	58 197	0.0	59 198	0.0	60 199	0.0
61 200	0.0	62 201	0.000E 01	63 202	0.0	64 203	0.0	65 204	1.000E 01
66 205	0.0	67 206	0.0	68 207	0.0	69 208	0.0	70 209	0.0
71 210	0.0	72 211	0.0	73 212	0.0	74 213	0.0	75 214	0.0
76 215	0.0	77 216	0.0	78 217	0.0	79 218	0.0	80 219	0.0
81 220	0.0	82 221	0.0	83 222	0.0	84 223	0.0	85 224	0.0
86 225	0.0	87 226	0.0	88 227	0.0	89 228	0.0	90 229	0.0
91 230	0.0	92 231	0.0	93 232	0.0	94 233	0.0	95 234	0.0
96 235	0.0	97 236	0.0	98 237	0.0	99 238	0.0	100 239	0.0
101 240	0.0	102 241	0.0	103 242	0.0	104 243	0.0	105 244	0.0
106 245	0.0	107 246	0.0	108 247	0.0	109 248	0.0	110 249	0.0
111 250	0.0	112 251	0.0	113 252	0.0	114 253	0.0	115 254	0.0
116 255	0.0	117 256	0.0	118 257	0.0	119 258	0.0	120 259	0.0
121 260	0.0	122 261	0.0	123 262	0.0	124 263	0.0	125 264	0.0
126 265	0.0	127 266	0.0	128 267	0.0	129 268	0.0	130 269	0.0
131 270	0.0	132 271	0.0	133 272	0.0	134 273	0.0	135 274	0.0
136 275	0.0	137 276	0.0	138 277	0.0	139 278	0.0	140 279	0.0
141 280	0.0	142 281	0.0	143 282	0.0	144 283	0.0	145 284	0.0
146 285	0.0	147 286	0.0	148 287	0.0	149 288	0.0	150 289	0.0
151 290	0.0	152 291	0.0	153 292	0.0	154 293	0.0	155 294	0.0
156 295	0.0	157 296	0.0	158 297	0.0	159 298	0.0	160 299	0.0
161 300	0.0	162 301	0.0	163 302	0.0	164 303	0.0	165 304	0.0
166 305	0.0	167 306	0.0	168 307	0.0	169 308	0.0	170 309	0.0
171 310	0.0	172 311	0.0	173 312	0.0	174 313	0.0	175 314	0.0
176 315	0.0	177 316	0.0	178 317	0.0	179 318	0.0	180 319	0.0
181 320	0.0	182 321	0.0	183 322	0.0	184 323	0.0	185 324	0.0
186 325	0.0	187 326	0.0	188 327	0.0	189 328	0.0	190 329	0.0
191 330	0								

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TABLE 57. - Continued

REXOR II (MARCH 74)

CASE DEMO-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

MASTER DATA (CONTINUED)

351 IXXP	1.500E-00	352 **OPEN**	0.0	353 **OPEN**	0.0	354 **OPEN**	0.0	355 **OPEN**	0.0
356 MASS	2.470E-01	357 YP(1)	3.310E-02	358 YP(2)	0.0	359 YP(3)	0.0	360 CLAG1	1.670E-04
371 CLAG2	5.000E-00	372 YFBA4	7.500E-01	373 YFBA4	0.0	374 ZFBA4	1.000E-01	375 **OPEN**	0.0
376 CMNDSP	1.000E-04	377 KTHCCH	1.000E-04	378 CMNDSP	5.000E-01	379 CTNDSP	5.000E-01	380 RTIP	9.700E-01
381 PCNPL	1.500E-01	382 PFH4	2.000E-01	383 PFH4	5.000E-01	384 PFHTAL	1.700E-01	385 PFHTW	5.000E-01
386 PSYTH	4.000E-01	387 TAURUD	2.500E-01	388 TAUEL	5.000E-01	389 TAUMT	1.000E-00	390 PCDFL	5.000E-01
391 PCDFL	4.000E-00	392 PCDFL	-1.430E-00	393 PCDAW	0.0	394 PCDAW	1.500E-03	395 PCDAW	-4.470E-02
396 PVAL	1.700E-03	397 PCDFL	1.430E-01	398 MDH	-1.300E-00	399 **OPEN**	0.0	400 **OPEN**	0.0
437 MATLYC	1.600E-00	438 MATLYC	1.670E-00	439 YDP1	1.000E-01	440 **OPEN**	0.0		
441 **OPEN**	0.0	442 **OPEN**	0.0	443 **OPEN**	0.0	444 **OPEN**	0.0	445 **OPEN**	0.0
446 **OPEN**	0.0	447 **OPEN**	0.0	448 **OPEN**	0.0	449 DZFM(1)	0.0	450 DZFM(2)	0.0
451 DZFM(3)	-4.000E-00	452 **OPEN**	0.0	453 DZFM(1)	0.0	454 DZFM(2)	0.0	455 DZFM(3)	-2.500E-00
456 **OPEN**	7.000E-00	457 **OPEN**	0.0	458 **OPEN**	0.0				
551 **OPEN**	0.0	552 **OPEN**	0.0	553 **OPEN**	0.0	554 **OPEN**	0.0	555 **OPEN**	0.0
556 **OPEN**	0.0	557 **OPEN**	0.0	558 **OPEN**	0.0	559 **OPEN**	0.0	560 **OPEN**	0.0
561 **OPEN**	1.120E-04	562 **OPEN**	5.000E-03	563 K1PRM	1.000E-00	564 K2PRM	3.000E-00	565 TAUG	7.500E-01
566 **OPEN**	0.0	567 **OPEN**	0.0	568 **OPEN**	0.0	569 **OPEN**	0.0	600 **OPEN**	0.0
1241 BLANK	6.000E-00	1242 BLANK	6.197E-04	1243 BLANK	6.745E-01	1244 BLANK	5.197E-04	1245 BLANK	1.920E-02
1246 BLANK	1.604E-00	1247 BLANK	5.745E-01	1248 BLANK	1.604E-00	1249 BLANK	3.440E-02	1250 CT4IM	5.700E-04
1251 CELY	5.700E-04	1252 CZERO	5.700E-04	1253 CUMK	1.000E-00	1254 **OPEN**	0.0	1255 **OPEN**	0.0
1256 CUMK	0.0	1257 THAPLS	0.0	1258 **OPEN**	0.0	1259 **OPEN**	0.0	1260 **OPEN**	0.0
1261 **OPEN**	0.0	1262 **OPEN**	0.0	1263 DONG	0.0	1264 DELCD	0.0	1265 **OPEN**	0.0
1266 **OPEN**	0.0	1267 TAN	0.0	1268 GAMMA	0.0	1269 PHREF	1.500E-01	1270 **OPEN**	0.0
1271 **OPEN**	0.0	1272 **OPEN**	0.0	1273 **OPEN**	0.0	1274 **OPEN**	0.0	1275 **OPEN**	0.0
1276 **OPEN**	1.000E-00	1277 CKSTOP	0.0	1278 **OPEN**	0.0	1279 **OPEN**	0.0	1280 **OPEN**	0.0
1281 **OPEN**	0.0	1282 **OPEN**	0.0	1283 **OPEN**	0.0	1284 **OPEN**	0.0	1285 **OPEN**	0.0
1286 **OPEN**	0.0	1287 **OPEN**	0.0	1288 **OPEN**	0.0	1289 **OPEN**	0.0	1290 **OPEN**	0.0
1291 **OPEN**	1.117E-02	1292 **OPEN**	0.0	1293 **OPEN**	0.0	1294 **OPEN**	0.0	1295 **OPEN**	0.0
1296 **OPEN**	0.0	1297 **OPEN**	0.0	1298 **OPEN**	0.0	1299 **OPEN**	0.0	1300 **OPEN**	0.0
1341 **OPEN**	0.0	1342 **OPEN**	0.0	1343 **OPEN**	0.0	1344 **OPEN**	0.0	1345 KTI	0.0
1346 KTI	0.0	1347 **OPEN**	0.0	1348 HTH	4.500E-00	1349 PTP1	1.640E-00	1350 PTP2	-9.000E-03
1351 PTP3	-4.000E-01	1352 AIP	-3.500E-00	1353 HP	5.000E-01	1354 SLP	-6.000E-00	1355 **OPEN**	0.0
1356 **OPEN**	0.0	1357 **OPEN**	0.0	1358 **OPEN**	0.0	1359 **OPEN**	0.0	1360 **OPEN**	0.0
1401 TCT	0.0	1402 **OPEN**	0.0	1403 **OPEN**	0.0	1404 **OPEN**	0.0	1405 **OPEN**	0.0

TABLE 57. - Continued

REXON 11 (MARCH 75)

CASE DEMO-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

MASTER DATA (CONTINUED)

1461 IXRG	1.500E 04	1462 IYVF	1.500E 05	1463 IZZF	1.140E 05	1464 IXVF		1465 IXZF	1.900E 03
1466 IYZF	0.0	1467 **OPEN**	0.0	1468 IZTH	8.870E 02	1469 ZSPZ	0.0	1470 **OPEN**	0.0
1471 IYXRG	1.000E 01	1472 IYVTR	7.000E 00	1473 GRTF	0.0	1474 GENG	0.0	1475 GTR	6.120E 00
1476 **OPEN**	0.0	1477 ZSPH	1.000E 00	1478 AKPH	4.000E 04	1479 DELZOB	0.0	1480 IMHORN	0.0
1481 VJOS	0.0	1482 ZJOS	0.0	1483 **OPEN**	0.0	1484 ENGMPX	0.0	1485 CFS	0.0
1486 **OPEN**	0.0	1487 KPH	0.0	1488 TPH	0.0	1489 **OPEN**	0.0	1490 **OPEN**	0.0
1491 **OPEN**	0.0	1492 **OPEN**	0.0	1493 **OPEN**	0.0	1494 FIDBLE	0.0	1495 **OPEN**	0.0
1496 **OPEN**	0.0	1497 TURFLG	0.0	1498 TSTOP	2.200E 00	1499 **OPEN**	0.0		
2555 ISALL	0.0	2556 **OPEN**	0.0	2557 **OPEN**	0.0	2558 **OPEN**	0.0	2559 FACIN	5.000E-01
2560 **OPEN**	0.0	2561 PHIZS	-2.000E 00	2562 THIZS	-5.000E 00	2563 PSIZS	0.0	2564 **OPEN**	0.0
2565 **OPEN**	0.0	2566 **OPEN**	0.0	2567 **OPEN**	0.0	2568 **OPEN**	0.0	2569 **OPEN**	0.0
2570 STATA	0.0								
2631 AXING	1.000E 00	2632 BXING	8.400E 00	2633 ADTH	1.620E 01	2634 RTR	5.320E 00	2635 CLATR	5.730E 00
2636 B	5.200E-01	2637 **OPEN**	0.0	2638 CUTOUT	6.100E 00	2639 **OPEN**	0.0	2640 **OPEN**	0.0

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TABLE 57. - Continued

REXCH II (MARCH 75)

CASE DEMO-2

DATE 2-15-78

COMBUND HELICOPTER DEMONSTRATION CASE:

TRIP CONTROL DEFINITIONS

37 NC 40,000 00

[illegible]

TABLE 57. - Continued

REXOR II (MARCH 78)

CASE DEMO-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

SHAFT STIFFNESS MATRIX

SHAFTK 401

5.000E 05	0.0	0.0	0.0	0.0	0.0
0.0	5.000E 05	0.0	0.0	0.0	0.0
0.0	0.0	1.000E 05	0.0	0.0	0.0
0.0	0.0	0.0	8.000E 05	0.0	0.0
0.0	0.0	0.0	0.0	8.000E 05	0.0
0.0	0.0	0.0	0.0	0.0	6.000E 07

SHAFT DAMPING MATRIX

SHFTC 2031

0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	1.000E 03	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	1.000E 05

2531 TMASS	1.250E 02	2532 XCGT	0.0	2533 YCGT	0.0	2534 ZCGT	0.0	2535 IXXT	2.500E 02
2536 IYVT	0.000E 02	2537 IZZT	5.000E 02	2538 IXYT	0.0	2539 IXZT	0.0	2540 IYZT	0.0

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TABLE 57. - Continued

REXOP 11 (MARCH 73)

CASE DEMO-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

BODY AERODYNAMIC DATA

ALFA	2601	-1.000E 02	-1.870E 02	-4.000E 01	-4.000E 01	-2.000E 01	-1.600E 01	-1.200E 01	-8.000E 00	-4.000E 00	0.0
		4.000E 00	8.000E 00	1.200E 01	1.600E 01	2.000E 01	4.000E 01	9.000E 01	1.670E 02	1.800E 02	0.0
CL	2621	0.0	2.800E 02	0.0	-1.930E 02	2.830E 02	-2.650E 02	-2.170E 02	-1.310E 02	-2.900E 01	7.000E 01
		1.940E 02	3.000E 02	3.970E 02	4.960E 02	5.180E 02	3.330E 02	0.0	-2.800E 02	0.0	0.0
CM	2641	0.0	0.0	0.0	-2.300E 00	-4.200E 01	-4.260E 01	-5.190E 01	-5.930E 01	-5.130E 01	-3.160E 01
		-1.000E 01	1.410E 01	4.610E 01	7.350E 01	9.280E 01	3.140E 01	0.0	0.0	0.0	0.0
CD	2661	2.780E 01	9.000E 01	1.335E 03	3.450E 02	9.730E 01	8.450E 01	5.980E 01	3.850E 01	2.790E 01	2.780E 01
		3.490E 01	4.700E 01	8.890E 01	9.550E 01	1.249E 02	4.200E 02	1.335E 03	4.000E 01	2.780E 01	0.0
FXRW	1751	8.000E 00	-1.900E 02	0.0	0.0	1.000E 00	9.000E 01	1.000E 00	1.800E 02	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FXRHT	1774	8.000E 00	-1.900E 02	0.0	0.0	1.000E 00	9.000E 01	1.000E 00	1.800E 02	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FXHTU	1201	1.000E 01	-1.800E 02	0.0	0.0	1.000E-01	6.500E 01	7.000E-01	1.000E 02	2.000E 00	1.800E 02
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FUSELAGE STABILITY DERIVATIVE MATRIX 441- 482											
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	-3.100E-01	-3.300E-01	0.0	0.0	0.0	-2.400E-01	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	-6.800E-01	0.0	-1.050E-01	0.0	0.0	0.0	0.0
0.0	0.0	0.0	-1.870E 02	0.0	0.0	-1.000E 00	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	-2.000E 01	0.0	-4.800E 00	0.0	0.0	0.0	0.0
0.0	0.0	-1.000E 00	0.0	0.0	0.0	9.200E 00	0.0	0.0	0.0	0.0	0.0

TABLE 57. - Continued

LEXUS II (MARCH 78)

CASE OFMO-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

SAS CONTROL DATA

SASOX	1941	0.0	-5.000E 01	-1.500E 02	1.000E-01	4.170E-03	5.000E 00	1.000E 01
SASDY	1944	0.0	-5.000E 01	-1.500E 02	0.0	4.170E-03	5.000E 00	1.000E 01
SASDEL	1955	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SASDAL	1962	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SASOTR	1969	0.0	-5.000E 01	-1.500E 02	1.000E-01	4.360E-03	3.000E 00	1.000E 01
SASOPD	1974	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CONTROL EQUATION CONSTANTS

74 PYPT	0.0	75 PYPT	0.0	76 PYPT	0.0				
86 GAINC	5.000E-01	87 GAINEL	1.000E 00	88 GAINTR	5.000E-01	89 GAINAL	1.000E 00	90 GAINMD	5.000E-01
1983 KXCF5	4.170E-03	1984 KYCF5	4.170E-03	1985 KFLFS	5.230E-03	1986 KAILFS	1.745E-03	1987 KTRFS	4.360E-03
1988 KXDF5	5.230E-03	1989 KTHFS	2.790E-03	1990 KPFS	1.000E 00	1991 KDBFS	1.010E-02	1992 KPLFS	5.230E-03
1993 KINF5	0.621E-03	1994 KIHTFS	1.386E-03						

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 57. - Continued

[illegible]

TABLE 57. - Continued

48704 81 (MARCH 76)

CASE DEMO-2

DATE 2-15-76

COMPOUND HELICOPTER DEMONSTRATION CASE

SIGNAL ARRAY DEFINITIONS

1500 SIGNALS 110.

SLCC 1401

[illegible]

1001

[illegible]

**ORIGINAL PAGE IS
OF POOR QUALITY**

TABLE 57. - Continued

RECORDED II (MARCH 73)

CASE DEMO-2

DATE 3-19-79

COMBINED HELICOPTER DEMONSTRATION CASE

BLAKE MODE SHAPE TABLES

MODE 1

[illegible]

CODE 2

[illegible]

TABLE 57. - Continued

REXOR II (MARCH 78)

CASE DEMO-2

DATE 8-18-78

COMPOUND HELICOPTER DEMONSTRATION CASE

403	NRAD	7.000E 00									
SV	501	1.450E 00 0.0	6.200E 00 0.0	1.550E 01 0.0	2.170E 01 0.0	2.635E 01 0.0	2.914E 01 0.0	3.190E 01 0.0	0.0 0.0	0.0 0.0	0.0 0.0
SV	521	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
VSC	1421	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
VIA	1441	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
OM	541	1.724E 00 0.0	6.435E-02 0.0	1.777E-01 0.0	2.014E-01 0.0	2.200E-01 0.0	2.519E-01 0.0	2.400E-01 0.0	0.0 0.0	0.0 0.0	0.0 0.0
BLADE POLAR INERTIA											
BT	501	7.824E-02 0.0	1.924E-02 0.0	2.087E-02 0.0	2.441E-02 0.0	2.441E-02 0.0	2.370E-02 0.0	1.610E-02 0.0	0.0 0.0	0.0 0.0	0.0 0.0
DSCDJ	1361	1.163E-09 0.0	2.500E-08 0.0	3.030E-09 0.0	3.704E-08 0.0	4.000E-09 0.0	4.000E-08 0.0	4.000E-08 0.0	0.0 0.0	0.0 0.0	0.0 0.0

ORIGINAL PAGE IS
OF POOR QUALITY

CASE DEMO-2

DATE 2-19-70

COMPOUND HELICOPTER DEMONSTRATION CASE

•LDF DATA

134 CYCLG	3-0	244 TSCLF	1.000F 00	300 NVAR	4.400H 01
-----------	-----	-----------	-----------	----------	-----------

WEC 1901

[illegible]

SVEC 2401

[illegible]

PRINT DATA

2899	PF457	1.730E C4	2900 NMP	3.100E 01
------	-------	-----------	----------	-----------

PP 2021

97.	99.	99.	100.	9.	101.	8.	9.	102.	103.
104.	105.	106.	107.	108.	109.	110.	111.	112.	113.
114.	115.	116.	117.	118.	119.	120.	121.	122.	123.
124.	125.	126.	127.	128.	129.	130.	131.	132.	133.
134.	135.	136.	137.	138.	139.	140.	141.	142.	143.
144.	145.	146.	147.	148.	149.	150.	151.	152.	153.
154.	155.	156.	157.	158.	159.	160.	161.	162.	163.
164.	165.	166.	167.	168.	169.	170.	171.	172.	173.
174.	175.	176.	177.	178.	179.	180.	181.	182.	183.
184.	185.	186.	187.	188.	189.	190.	191.	192.	193.
194.	195.	196.	197.	198.	199.	200.	201.	202.	203.
204.	205.	206.	207.	208.	209.	210.	211.	212.	213.
214.	215.	216.	217.	218.	219.	220.	221.	222.	223.
224.	225.	226.	227.	228.	229.	230.	231.	232.	233.
234.	235.	236.	237.	238.	239.	240.	241.	242.	243.
244.	245.	246.	247.	248.	249.	250.	251.	252.	253.
254.	255.	256.	257.	258.	259.	260.	261.	262.	263.
264.	265.	266.	267.	268.	269.	270.	271.	272.	273.
274.	275.	276.	277.	278.	279.	280.	281.	282.	283.
284.	285.	286.	287.	288.	289.	290.	291.	292.	293.
294.	295.	296.	297.	298.	299.	300.	301.	302.	303.
304.	305.	306.	307.	308.	309.	310.	311.	312.	313.
314.	315.	316.	317.	318.	319.	320.	321.	322.	323.
324.	325.	326.	327.	328.	329.	330.	331.	332.	333.
334.	335.	336.	337.	338.	339.	340.	341.	342.	343.
344.	345.	346.	347.	348.	349.	350.	351.	352.	353.
354.	355.	356.	357.	358.	359.	360.	361.	362.	363.
364.	365.	366.	367.	368.	369.	370.	371.	372.	373.
374.	375.	376.	377.	378.	379.	380.	381.	382.	383.
384.	385.	386.	387.	388.	389.	390.	391.	392.	393.
394.	395.	396.	397.	398.	399.	400.	401.	402.	403.
404.	405.	406.	407.	408.	409.	410.	411.	412.	413.
414.	415.	416.	417.	418.	419.	420.	421.	422.	423.
424.	425.	426.	427.	428.	429.	430.	431.	432.	433.
434.	435.	436.	437.	438.	439.	440.	441.	442.	443.
444.	445.	446.	447.	448.	449.	450.	451.	452.	453.
454.	455.	456.	457.	458.	459.	460.	461.	462.	463.
464.	465.	466.	467.	468.	469.	470.	471.	472.	473.
474.	475.	476.	477.	478.	479.	480.	481.	482.	483.
484.	485.	486.	487.	488.	489.	490.	491.	492.	493.
494.	495.	496.	497.	498.	499.	500.	501.	502.	503.
504.	505.	506.	507.	508.	509.	510.	511.	512.	513.
514.	515.	516.	517.	518.	519.	520.	521.	522.	523.
524.	525.	526.	527.	528.	529.	530.	531.	532.	533.
534.	535.	536.	537.	538.	539.	540.	541.	542.	543.
544.	545.	546.	547.	548.	549.	550.	551.	552.	553.
554.	555.	556.	557.	558.	559.	560.	561.	562.	563.
564.	565.	566.	567.	568.	569.	570.			

MARKETIC ANALYSIS DATA

2306 MUSIC C.C.

MS 16 2321

[illegible]

TABLE 57. - Continued

AEROC 11 (MARCH 70)

CASE DEMO-2

DATE 2-19-78

COMPOUND HELICOPTER DEMONSTRATION CASE

MODE 3

921 - 940										
0.0	-7.79E-02	-1.2654E-01	-4.4818E-02	7.697E-02	1.642E-01	2.240E-01	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
941 - 960										
0.0	-3.157E-01	-5.425E-01	-7.184E-01	3.210E-01	7.237E-01	1.000E+00	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
961 - 980										
0.0	-1.320E-02	4.484E-03	2.130E-02	3.028E-02	3.199E-02	3.215E-02	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
981 - 1000										
0.0	-5.459E-02	1.551E-02	9.644E-02	1.366E-01	1.481E-01	1.492E-01	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TORSION MODE

2071 - 2090										
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

FEATHERING BEARING LOCATIONS

Y-IN Z-IN Y-OUT Z-OUT

275 - 277	MODE 1	1.616E-02	-3.288E-04	3.403E-02	-6.924E-05
278 - 282	MODE 2	-3.699E-05	1.599E-02	-7.769E-05	3.366E-02
283 - 285	MODE 3	-7.716E-05	-3.108E-02	-1.624E-02	-6.543E-02

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 57. - Continued

REX31 II (MARCH 78)

CASE DEMO-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

INITIAL CONDITIONS

BENDING MODES

V	2141						
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
VD	2152						
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
VDD	2143						
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0	0.0

ELASTIC FEATHERING

PIN	2571						
		0.0	0.0	0.0	0.0	0.0	0.0
PIND	2573						
		0.0	0.0	0.0	0.0	0.0	0.0
PINDD	2544						
		0.0	0.0	0.0	0.0	0.0	0.0

DYNAMIC TORSION

PTIV	2501						
		0.0	0.0	0.0	0.0	0.0	0.0
PTID	2502						
		0.0	0.0	0.0	0.0	0.0	0.0
PTINDD	2515						
		0.0	0.0	0.0	0.0	0.0	0.0

TABLE 57. - Continued

HEXOR II (MARCH 76)

CASE DEMO-2

DATE 2-19-76

GIMPRUND HELICOPTER DEMONSTRATION CASE

INITIAL CONDITIONS

SHAFT

SSI 1	310	0.0	0.0	0.0	0.0	0.0	0.0
QSSI 1	315	0.0	0.0	0.0	0.0	0.0	0.0
QDSSI 1	322	0.0	0.0	0.0	0.0	0.0	0.0

SWASHPLATE

SSPI 1	301	0.0	0.0	0.0
QSSPI 1	304	0.0	0.0	0.0
QDSSPI 1	307	0.0	0.0	0.0

REFERENCE

323 P REF 1	0.0	329 Q REF 1	0.0	330 R REF 1	0.0	331 XDDREF 1	0.0	332 YDDREF 1	0.0
333 ZDDREF 1	-3.2175 G1	334 PD REF 1	0.0	335 QD REF 1	0.0	336 RD REF 1	0.0		

ORIGINAL PAGE IS
OF POOR QUALITY

CASE DEMO-2

DATE 2-19-76

COMBUND HELICOPTER DEMONSTRATION CASE:

INITIAL CONDITIONS

QUASI-STATIC TORSION

[illegible]

QUASI-STATIC PITCH HORN

DFF	2901	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DFFD	2903	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DFFCD	2915	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 57. - Continued

HEXOR II (MARCH 79)

CASE DEMO-2

DATE 2-15-79

COMPTON HELICOPTER DEMONSTRATION CASE

LIST OF CHANGES TO MASTER DATA

7 VSP	0.0
34 THFTRO	0.0
36 TCUT	0.0000 00
41 PDJHI	1.5000 01
45 ISWP	1.0000 00
53 PACY	2.0000 01
54 PVCT	0.0000 00
55 PVCT	1.0000 01
56 PTNCT	2.0000 01
57 PDPT	0.0000 01
58 ALPHA	0.0000 00
62 VT	1.5000 02
65 HMR	3.0000 00
112 DINTU	-2.0000 00
123 CKXCS	0.7000-01
124 CKXCS	0.7000-01
467 FMN	0.0
469 FMN	0.0
1321 CVE	2.0000-03
1323 CVE	2.0000-03
1324 CVE	1.0000 00
1325 CVE	1.0000 00
1326 CVE	1.0000 00

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 57. - Continued

ARXOR 11 (MARCH 78)

CASE DEMO-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

1532 CVK	5.000E-01
1945 SASOX	0.0
1952 SASOV	0.0
1973 SASOTR	0.0
2561 PHIZC	0.0
2562 THYZC	0.0
2599 PEREC	1.000E 01

TABLE 57. - Continued

REFUG II (MARCH 74)

CASE OFMO-2

DATE 2-13-78

COMPOUND HELICOPTER DEMONSTRATION CASE

THIS IS THE GENERALIZED MASS MATRIX

	1 6 17 25	2 10 18 26	3 11 19 27	4 12 20 28	5 13 21 29	6 14 22 30	7 15 23 31	8 16 24 32
1	0.211621E 01							
2	-0.4236612E-02	0.211207E 01						
3	-0.950639E 00	0.541967E 00	0.174834E 01					
4	0.0	0.0	0.0	0.177033E 01				
5	0.0	0.0	0.0	0.0	0.211597E 01			
6	0.0	0.0	0.0	0.0	-0.514243E-02	0.211174E 01		
7	0.0	0.0	0.0	0.0	-0.111335E 01	0.622207E 00	0.102406E 01	
8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.177033E 01
9	0.0 0.211634E 01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.0 -0.423691E-02	0.0 0.211212E 01	0.0	0.0	0.0	0.0	0.0	0.0
11	0.0 -0.919265E 00	0.0 0.545229E 00	0.0 0.171570E 01	0.0	0.0	0.0	0.0	0.0
12	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.177033E 01	0.0	0.0	0.0	0.0
13	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.211733E 01	0.0	0.0	0.0

ORIGINAL PAGE IS
OF POOR QUALITY

TABLE 57. - Continued

	1 9 17 25	2 10 18 26	3 11 19 27	4 12 20 28	5 13 21 29	6 14 22 30	7 15 23 31	8 16 24 32
14	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 -0.293028E-02	0.0 0.211243E 01	0.0	0.0
15	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 -0.637573E 00	0.0 0.517420E 00	0.0 0.147340E 01	0.0
16	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.177033E 01
17	0.0 0.0 0.211727E 01	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
18	0.0 0.0 -0.303047E-02	0.0 0.0 0.211242E 01	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
19	0.0 0.0 -0.557465E 00	0.0 0.0 0.522913E 00	0.0 0.0 0.149828E 01	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
20	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.0	0.0 0.0 0.177033E 01	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0
21	0.0 -0.171820E 01 0.276014E 01	0.0 0.907046E-04 -0.134907E-03	0.0 0.764520E 00 -0.925879E 00	0.0 0.0 0.0	-0.278014E 01 0.171822E 01 0.195300E 03	0.169393E-03 -0.825540E-04	0.147356E 01 -0.557552E 00	0.0 0.0
22	0.292318E 01 -0.230490E 01 0.903318E 00	-0.157586E-03 0.124744E-03 -0.435009E-04	-0.134169E 01 0.105227E 01 -0.300834E 00	0.0 0.0 0.0	0.903323E 00 -0.236494E 01 0.0	-0.550390E-04 0.113626E-03 0.195300E 03	-0.477816E 00 0.767408E 00	0.0 0.0
23	-0.636130E-02 -0.616394E-02 -0.457921E-02	0.291952E 01 0.291847E 01 0.291809E 01	0.110777E 00 0.102118E 00 0.220040E-01	0.0 0.0 0.0	-0.734041E-02 -0.445753E-02 0.0	0.291875E 01 0.291807E 01 0.0	0.149664E 00 0.150735E-01 0.195300E 03	0.0 0.0

TABLE 57. - Continued

	1 0 17 25	2 10 18 26	3 11 19 27	4 12 20 28	5 13 21 29	6 14 22 30	7 15 23 31	8 16 24 32
24	0.730795E 01 -0.594040E 01 0.234970E 01	-0.393065E-03 -0.341395E 02 0.613174E 02	-0.33422E 01 -0.760393E 01 0.139973E 02	-0.116001E 01 0.955247E 00 -0.364680E 00	0.211649E 01 -0.585727E 01 0.0	-0.633081E 02 0.391326E 02 0.486039E 03	-0.198156E 02 0.109166E 02 -0.167847E-03	-0.364892E 00 0.955299E 00 0.717457E 04
25	0.130600E 00 0.419269E 01 -0.640166E 01 0.717477E 04	0.665709E 02 -0.536576E-02 0.205733E 02	0.176201E 02 -0.160607E 02 0.710702E 01	0.0 -0.694045E 00 0.112302E 01	0.699642E 01 -0.437136E 01 -0.486039E 03	0.205696E 02 -0.532611E 02 0.0	0.204903E 01 -0.110184E 02 -0.213623E-03	-0.112302E 01 0.694045E 00 -0.996593E-03
26	-0.666338E 02 -0.666407E 02 -0.666547E 02 0.414613E-01	0.269294E 00 0.290759E 00 0.192105E 00 0.119261E 05	0.300495E 02 0.290224E 02 0.208337E 02	0.0 0.0 0.0	-0.666291E 02 -0.666557E 02 0.167847E-03	0.311529E 00 0.166812E 00 0.213623E-03	0.351654E 02 0.202017E 02 0.0	0.0 0.0 0.172895E-01
27	0.0 -0.171870E 01 0.275014E 01 -0.486039E 03	0.0 0.907046E-04 -0.153497E-03 0.167847E-03	0.0 0.764520E 00 -0.925879E 00 0.976300E 03	0.0 0.0 0.0	-0.273014E 01 0.171822E 01 0.195300E 03	0.169393E-03 -0.924540E-04 0.0	0.147356E 01 -0.557552E 00 0.0	0.0 0.0 0.0
28	0.292310E 01 -0.236490E 01 0.903310E 00 0.0	-0.157534E-03 0.174644E-03 -0.435089E-04 0.213623E-03	-0.134160E 01 0.105227E 01 -0.360834E 00 0.0	0.0 0.0 0.0 0.976300E 03	0.903323E 00 -0.236494E 01 0.0	-0.550390E-04 0.113625E-03 0.195300E 03	-0.477416E 00 0.767608E 03 0.0	0.0 0.0 0.496039E 03
29	-0.636103E-02 -0.616394E-02 -0.457921E-02 -0.213623E-03	0.291852E 01 0.291847E 01 0.291809E 01 0.0	0.110777E 00 0.102118E 00 0.220040E-01 0.0	0.0 0.0 0.0	-0.734041E-02 -0.445753E-02 0.0 0.976300E 03	0.291875E 01 0.291807E 01 0.0	0.149464E 00 0.150735E-01 0.195300E 03	0.0 0.0 -0.167847E-03
30	0.192345E 02 -0.155356E 02 0.503324E 01 -0.996593E-03	-0.103692E-02 -0.301291E 02 0.503317E 02 0.161611E-01	-0.882829E 01 -0.331267E 01 0.127699E 02 0.0	-0.118081E 01 0.955297E 00 -0.364089E 00 0.120476E 04	0.580205E 01 -0.155062E 02 0.0 -0.167847E-03	-0.633083E 02 0.391301E 02 0.122286E 04 0.393995E 05	-0.207651E 02 0.140676E 02 -0.167847E-03	-0.364892E 00 0.955299E 00 0.915761E 04
31	0.130608E 00 0.112302E 02 -0.172633E 02 0.915761E 04	0.665709E 02 -0.536576E 02 0.265739E 02 0.407773E-01	0.176201E 02 -0.191200E 02 0.108045E 02 -0.120475E 04	0.0 -0.694045E 00 0.112302E 01 0.0	0.183394E 02 -0.113817E 02 -0.126286E 04 -0.595750E 03	0.205696E 02 -0.533608E 02 0.0 -0.996593E-03	-0.395067E 01 -0.874363E 01 -0.213623E-03 0.122302E 04	-0.112302E 01 0.694045E 00 -0.148487E-02

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TABLE 57. - Continued

	1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16
	17	18	19	20	21	22	23	24
	25	26	27	28	29	30	31	32
32	-0.555338E 02	0.269374E 00	0.370485E 02	0.0	-0.666291E 02	0.31152-E 00	0.351654E 02	0.0
	-0.666437E 02	0.269375E 00	0.290224E 02	0.0	-0.666557E 02	0.186812E 00	0.202087E 02	0.0
	-0.666547E 02	0.197105E 00	0.209337E 02	0.0	0.167947E-03	0.213623E-03	0.0	0.172895E-01
	0.414618E-01	0.119241E 05	0.167847E-01	0.595756E 03	0.0	-0.155856E 04	0.407770E-01	0.128365E 06

TABLE 57. - Continued

APR 11 1948 7:1.

CASE 5940-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

THE CASE IS COMPLETED. TIME = 3.0359 CYCLE = 10. AZIMUTH = 110.
 TIME TOOK 1 CYCLE WHICH IS 0.4951 SECONDS.

THE NUMBER OF PLOTS SAVED IN THE SIGNAL SET IS 229
 THE SIGNAL SAVE FREQUENCY USED WAS 11

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TABLE 57. - Continued

MARCH 11 (MARCH 78)

CASE DEMO-2

DATE: 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

TIME	ROL AHA TOTAL LAT STK PLANS	ATASPEED ROTATION CONVERT DIV 04A	TRAJ VEL ROTATION COLLECTV WING INC	ATAK ANG PUSLLIAT TAILCOL TAIL INC	STOESLIP PUSLONAG ELVATION COLDWASH	CLINBANG PUSPITCH AILTRONS LATOWASH	PITCH AT T4THHIST WIMORH L4NDWASH	ROLL ATT JETTHIST JETSETNE
0.0	0.0 0.000000-01 0.0	0.212000-02 -0.000000-02 0.0	0.250170-03 -0.000000-04 0.0	0.000000-01 -0.213100-05 0.0	0.0 0.242600-04 0.0	-0.000000-05 0.131120-04 0.0	0.000000-01 -0.000000-02 0.0	0.0 0.000000-04 0.0
0.13520	0.000000-01 0.000000-04 0.0	0.212000-02 -0.000000-03 0.0	0.250170-03 0.130000-03 0.0	0.000000-01 -0.220000-05 0.0	0.0 0.244000-04 0.0	-0.101700-04 0.101700-04 0.0	0.000000-01 -0.000000-02 0.0	0.0 0.000000-04 0.0
0.27000	0.000000-01 0.000000-04 0.0	0.212000-02 -0.000000-03 0.0	0.250170-03 0.130000-03 0.0	0.000000-01 -0.220000-05 0.0	0.0 0.244000-04 0.0	-0.101700-04 0.101700-04 0.0	0.000000-01 -0.000000-02 0.0	0.0 0.000000-04 0.0
0.40070	0.000000-01 0.000000-04 0.0	0.212000-02 -0.000000-03 0.0	0.250170-03 0.130000-03 0.0	0.000000-01 -0.220000-05 0.0	0.0 0.244000-04 0.0	-0.101700-04 0.101700-04 0.0	0.000000-01 -0.000000-02 0.0	0.0 0.000000-04 0.0
0.54100	0.000000-01 0.000000-04 0.0	0.212000-02 -0.000000-03 0.0	0.250170-03 0.130000-03 0.0	0.000000-01 -0.220000-05 0.0	0.0 0.244000-04 0.0	-0.101700-04 0.101700-04 0.0	0.000000-01 -0.000000-02 0.0	0.0 0.000000-04 0.0
0.67000	0.000000-01 0.000000-04 0.0	0.212000-02 -0.000000-03 0.0	0.250170-03 0.130000-03 0.0	0.000000-01 -0.220000-05 0.0	0.0 0.244000-04 0.0	-0.101700-04 0.101700-04 0.0	0.000000-01 -0.000000-02 0.0	0.0 0.000000-04 0.0
0.81100	0.000000-01 0.000000-04 0.0	0.212000-02 -0.000000-03 0.0	0.250170-03 0.130000-03 0.0	0.000000-01 -0.220000-05 0.0	0.0 0.244000-04 0.0	-0.101700-04 0.101700-04 0.0	0.000000-01 -0.000000-02 0.0	0.0 0.000000-04 0.0
0.94000	0.000000-01 0.000000-04 0.0	0.212000-02 -0.000000-03 0.0	0.250170-03 0.130000-03 0.0	0.000000-01 -0.220000-05 0.0	0.0 0.244000-04 0.0	-0.101700-04 0.101700-04 0.0	0.000000-01 -0.000000-02 0.0	0.0 0.000000-04 0.0

TABLE 57. - Continued

MARCH 11 (MARCH 78)

CASE DEMO-2

DATE 2-15-78

COMPOUND HELICOPTER DEMONSTRATION CASE

TIME	HLI AZM THRLIFT LAT STIA FLAPS	RTASPEED ROTTHROG LONGSTIK DIVE RTA	TRAJ VEL ROTTHROG COLLECTV WING INC	ATAK ANG HUSLLIFT TAILACOL TAIL INC	STOPSLLP HUSLORAG ELEVATOR COLOWASH	CLIMRANG HUSPITCH AILERONS LATDASH	PITCH AT TETTRUST RUDDER LYCOWASH	ROLL ATT JETTHRST JETSETHG
1.09268	0.23637E 02 0.75179E 04 0.23744E-01 0.0	0.21290E 02 0.17744E 02 0.20852E-01 0.0	0.25301E 03 0.39674E 04 0.55860E-01 0.22519E 01	0.60355E 01 -0.22649E 03 0.23805E-01 0.0	0.31244E-01 0.31490E 04 0.67141E 01 0.25816E 01	-0.19713E-01 0.13007E 04 0.30113E 01 0.97688E-02	0.06669E 01 0.22141E 03 0.14342E 01 -0.10744E 00	0.65392E 00 0.40216E 04 0.63086E 02
1.21729	0.23191E 02 0.77235E 04 0.22533E-01 0.0	0.21290E 02 0.75735E 03 0.44752E-01 0.0	0.25244E 03 0.30979E 04 0.55860E-01 0.22519E 01	0.60207E 01 -0.21975E 03 0.23405E-01 0.0	0.14059E 00 0.31453E 04 0.67341E 01 0.26759E 01	-0.33448E-01 0.13462E 04 0.29401E 01 0.34770E-02	0.60503E 01 0.14240E 03 0.16342E 01 -0.41024E-01	0.12330E 01 0.40233E 04 0.63086E 02
1.35251	0.22579E 02 0.76431E 04 0.22579E-01 0.0	0.21290E 02 0.55851E 03 0.40752E-01 0.0	0.25273E 03 0.40820E 04 0.55860E-01 0.22519E 01	0.60792E 01 -0.21940E 03 0.23405E-01 0.0	0.47356E 00 0.31470E 04 0.67341E 01 0.26759E 01	-0.34354E-01 0.13466E 04 0.19424E 01 -0.16028E-01	0.60558E 01 0.14449E 03 0.16342E 01 -0.23394E-01	0.25066E 01 0.40243E 04 0.63086E 02
1.48773	0.21474E 02 0.74479E 04 -0.21434E-01 0.0	0.21290E 02 0.66942E 03 0.40752E-01 0.0	0.25250E 03 0.21710E 04 0.55860E-01 0.22519E 01	0.60617E 01 -0.21912E 03 0.23805E-01 0.0	0.49075E 00 0.31547E 04 0.67341E 01 0.25919E 01	-0.57892E-01 0.47708E 03 -0.20542E 01 -0.23195E-01	0.60373E 01 0.14449E 03 0.16342E 01 0.12344E 00	0.39688E 01 0.40260E 04 0.63086E 02
1.52295	0.24355E 02 0.65151E 04 -0.42453E-01 0.0	0.21290E 02 -0.40301E 03 0.40752E-01 0.0	0.25253E 03 0.19795E 04 0.55860E-01 0.22519E 01	0.60153E 01 -0.21915E 03 0.23405E-01 0.0	0.96095E 00 0.31460E 04 0.67341E 01 0.24779E 01	-0.40405E-01 0.13091E 04 -0.20342E 01 -0.23188E-02	0.59947E 01 0.15151E 03 0.16342E 01 0.71764E-01	0.49055E 01 0.40263E 04 0.63086E 02
1.75817	0.23743E 02 0.75820E 04 -0.27073E-01 0.0	0.21290E 02 0.97250E 03 0.40752E-01 0.0	0.25240E 03 0.37550E 03 0.55860E-01 0.22519E 01	0.59399E 01 -0.21637E 03 0.23805E-01 0.0	0.11094E 01 0.31243E 04 0.67341E 01 0.24799E 01	-0.13016E 00 0.11679E 04 -0.94347E 00 0.30328E-02	0.58726E 01 0.15240E 03 0.16342E 01 -0.21284E-01	0.47640E 01 0.40275E 04 0.63086E 02
1.89339	0.40310E 02 0.71011E 04 0.14422E-01 0.0	0.21290E 02 -0.54727E 03 0.40752E-01 0.0	0.25236E 03 -0.11491E 04 0.55860E-01 0.22519E 01	0.58391E 01 -0.21410E 03 0.23805E-01 0.0	0.11419E 01 0.33657E 04 0.67341E 01 0.24300E 01	-0.15179E 03 0.06699E 01 0.94047E 00 0.56738E-02	0.57437E 01 0.16434E 03 0.16342E 01 -0.83124E-01	0.40647E 01 0.40208E 04 0.64471E 02
2.02861	0.43139E 02 0.75439E 04 0.20003E-01 0.0	0.21290E 02 0.66719E 03 0.40752E-01 0.0	0.25267E 03 0.18974E 04 0.55860E-01 0.22519E 01	0.57392E 01 -0.20924E 03 0.23805E-01 0.0	0.11074E 01 0.86709E 04 0.67341E 01 0.24740E 01	-0.22846E 00 -0.40744E 04 0.94047E 00 0.14967E-01	0.55651E 01 0.16378E 03 0.16342E 01 -0.33228E-01	0.51626E 01 0.40430E 04 0.67088E 02

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TABLE 57. - Concluded

REVER II (MARCH 71)			CASE DEMO-2			DATE 2-15-78		
COMPOUND HELICOPTER DEMONSTRATION CASE								
TIME	SLI LPM TOTALIFT LAT STIK PLAPS	RTSPED RTMDRAG LONGSTIK DIVE BRA	TRAJ VEL ROTATORO COLLECTV WING INC	ATAK ANG FUSLLINT TAILCOL TAIL INC	SIDFSLIP FUSLDRAG ELEVATOR COLDWASH	CLIMBANG FUSPITCH AILERONS LATOWASH	PITCH AT TATWROST RHOORR LNGOWASH	ROLL AT JETTHYST JETSETNG
2.15384	0.440000-02 0.272707-04 0.220000-01 0.0	0.212900-02 -0.234170-03 0.460000-01 0.0	0.255840-03 0.267800-04 0.558000-01 0.225190-01	0.555110-01 -0.204600-05 0.238000-01 0.0	0.105500-01 0.156210-05 0.673410-01 0.247720-01	-0.248440-00 -0.102200-05 0.960470-00 -0.247200-02	0.542340-01 0.160120-03 0.163620-01 0.711240-02	0.292330-01 0.166360-03 0.109540-02
2.29006	0.440000-02 0.274000-04 0.220000-01 0.0	0.212900-02 0.416000-03 0.460000-01 0.0	0.255840-03 0.261510-04 0.558000-01 0.225190-01	0.544400-01 -0.204600-05 0.238000-01 0.0	0.990260-00 0.105750-05 0.673410-01 0.247720-01	-0.248440-00 -0.102200-05 0.960470-00 0.112140-01	0.542740-01 0.160340-03 0.163620-01 0.434120-02	0.190210-01 0.116370-03 0.943010-02
2.43428	0.440000-02 0.274000-04 0.220000-01 0.0	0.212900-02 -0.231700-03 0.460000-01 0.0	0.255840-03 0.267800-04 0.558000-01 0.225190-01	0.547120-01 -0.212000-05 0.238000-01 0.0	0.935130-00 0.164400-04 0.673410-01 0.247720-01	-0.231210-00 -0.170000-04 0.960470-00 -0.248440-01	0.541000-01 0.170000-03 0.163620-01 0.440000-02	0.158000-01 0.576700-04 0.715540-02
2.56950	0.440000-02 0.274000-04 0.220000-01 0.0	0.212900-02 0.197710-03 0.460000-01 0.244210-02	0.255840-03 0.261510-04 0.558000-01 0.225190-01	0.542370-01 -0.212000-05 0.238000-01 0.0	0.990600-00 0.242310-04 0.673410-01 0.247720-01	-0.440410-00 -0.203770-04 0.960470-00 0.210700-02	0.540120-01 0.170000-03 0.163620-01 0.440000-02	0.127490-01 0.399360-04 0.630860-02
2.70472	0.440000-02 0.274000-04 0.220000-01 0.0	0.212900-02 -0.163410-03 0.460000-01 0.244210-02	0.255840-03 0.260700-03 0.558000-01 0.225190-01	0.552660-01 -0.211410-05 0.238000-01 0.0	0.826500-00 0.186950-04 0.673410-01 0.216400-01	-0.440370-00 -0.383700-04 0.960470-00 -0.161000-01	0.497700-01 0.170100-03 0.163620-01 -0.177010-02	0.108240-01 0.399360-04 0.630860-02
2.83594	0.440000-02 0.274000-04 0.220000-01 0.0	0.212900-02 -0.211410-03 0.460000-01 0.130000-02	0.255840-03 -0.158500-04 0.558000-01 0.225190-01	0.519400-01 -0.203040-05 0.238000-01 0.0	0.751950-00 0.253650-04 0.673410-01 0.211300-01	-0.376410-00 -0.143440-04 0.960470-00 -0.240320-02	0.463460-01 0.182400-03 0.163620-01 -0.321400-02	0.927360-00 0.399360-04 0.630860-02
2.97517	0.440000-02 0.274000-04 0.220000-01 0.0	0.212900-02 0.174500-03 0.460000-01 0.0	0.255840-03 -0.247900-04 0.558000-01 0.225190-01	0.504880-01 -0.204900-05 0.238000-01 0.0	0.838530-00 0.274650-04 0.673410-01 0.201070-01	-0.674450-00 -0.933360-03 0.960470-00 -0.131400-01	0.438300-01 0.192230-03 0.163620-01 -0.270400-02	0.848660-00 0.399360-04 0.630860-02
3.08334	0.440000-02 0.274000-04 0.220000-01 0.0	0.212900-02 -0.245400-03 0.460000-01 0.0	0.255840-03 -0.245000-04 0.558000-01 0.225190-01	0.492970-01 -0.202730-05 0.238000-01 0.0	0.837020-00 0.276120-04 0.673410-01 0.196670-01	-0.704020-00 -0.130400-04 0.960470-00 -0.704010-02	0.415210-01 0.196580-03 0.163620-01 -0.624700-02	0.792840-00 0.399360-04 0.630860-02

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6. COMPUTER INSTALLATION REQUIREMENTS

REXOR II is written entirely in FORTRAN IV and has been developed on an IBM 360/91 computer. Hardware dependency is restricted to only a few major software areas:

1. Fortran initialization of literal data is word size dependent.
2. Graphic output software is Calcomp dependent.

Software incompatibilities are restricted to:

1. Character string definition techniques.
2. Overlay features.

REXOR II will run on any IBM 360 or 370 model which is large enough to support IBM's FORTRAN IV H-level compiler. One routine in REXOR II, namely SWEEP1, requires 490 k bytes of core to compile. This is the pacing item on IBM core requirements. Besides the normal FORTRAN input, output, and punch output devices, REXOR II utilizes three auxiliary storage I/O units. The I/O operations are sequential; thus, the actual device type is not important. All installation dependent software has been removed to enhance portability, except as mentioned above, in the area of graphic output.

Besides its parent installation, REXOR II has been installed at the Langley Research Center computer complex which includes CDC 6000 series computers and software. Specifics concerning the program as installed on IBM and CDC hardware, and in particular the installations mentioned, will be presented below.

6.1 IBM 360/370 Series Hardware

REXOR II requires a minimum of 490 k bytes of core for compilation. This requirement is due to subroutine SWEEP1. If SWEEP1 is compiled separately, the compilation core requirement is substantially reduced. The core requirement during execution is approximately 260 k bytes when the overlay option of the LINKAGE EDITOR program is invoked. A general schematic of the IBM overlay structure is presented in Figure 11. The program was somewhat arbitrarily divided into the classic INPUT-PROCESS-OUTPUT categories. The current structure is not minimal in design.

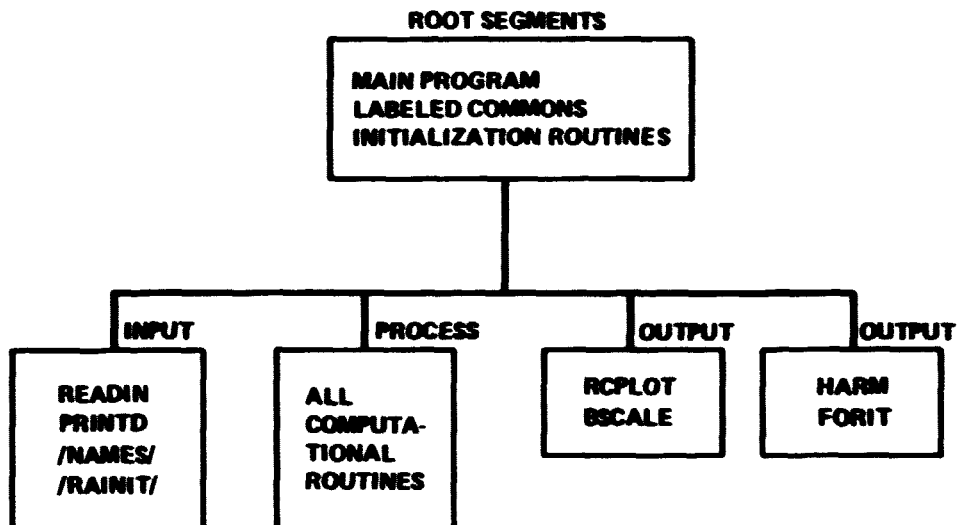


Figure 11. - I.B.M. overlay structure.

The program logical I/O unit numbers and usage are indicated in the following Table 58.

TABLE 58. I/O UNITS	
Unit #	Usage
5	Normal Fortran Input Data Set
6	Normal Fortran Output Data Set
7	Punch Card Output Data Set
10	Scratch Data Set
12	Scratch Data Set
14	Scratch Data Set

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The device requirements for the scratch units 10, 12, and 14 are direct access or magnetic tape. Typical DCB parameters are:

```
UNIT 12 -   RECFM=FB, LRECL=80, BLKSIZE=800
          10 -   RECFM=VSB, BLKSIZE=3240
          14 -   RECFM=VSB, BLKSIZE=3240
```

The space parameter of the data definition control statement is a function of the actual device used. The following normal working limits should be allocated. However, these numbers are not absolute.

```
UNIT 12 -   80 k bytes
          14 -   12 k bytes
          10 -   480 k bytes
```

Unit 10 is used to save the signal set. Thus, space allocation is a function of signal save frequency and length of trajectory and should be reviewed with these parameters in mind.

A sample job control language (JCL) set is given in Figure 12 which summarizes the IBM setup information.

6.2 CDC 6000 and 7000 Series Hardware

REXOR II has been installed on CDC hardware at LRC, Langley Research Center. Software requirements in the area of literal definitions and overlay capabilities are significantly different from IBM. Therefore, a separate CDC compatible version must be maintained.

The complete source and object are stored at the LRC computer center on disc and tape (source only). CDC core requirement for compilation (OPT=1) is approximately 60,000 octal words. The field length for the execution phase is approximately 140,000 words. CDC 6600 compilation time for the complete program has been measured at approximately 200 seconds. The program auxiliary storage device requirements are the same as described in Section 6.1. Beyond the actual definition of the units, the program accepts default system definitions.

The CDC overlay structure is conceptually similar to the IBM version; however, the physical implementation is quite different. The CDC overlay program structure is presented in Figure 12.

6.3 Graphic Hardware/Software Requirements

Graphic output capability is highly installation dependent. Even though the two installations at which REXOR II has been installed all use CALCOMP


```

INSERT SHAPTM
INSERT RFFM
INSERT ROTORM
INSERT RNETOR
INSERT ONETOR
INSERT SWEEP1
INSERT STALL
INSERT XTAP1
INSERT HURE
INSERT SWASHE
INSERT SHAPTE
INSERT REFF
INSERT LOADS
INSERT ROTORE
INSERT MYMILE
INSERT MTMILE
INSERT MYCUT
INSERT AUMOUT
INSERT CHOSKY
INSERT COMES
INSERT JETIA
OVERLAY ALPHA
INSERT RAINIT
INSERT NAMES
INSERT PRINTD
INSERT READIN
OVERLAY ALPHA
INSERT RSCALE
INSERT RCPLOT
OVERLAY ALPHA
INSERT WARM
INSERT RINIT
/*
//G EXEC 29M=*.L.SYSLMOD,COND=((1,LT,C),(5,LT,L)),TIME=10
//FT05F001 END

<DATA>

//FT06F001 DD SYSOUT=A
//FT07F001 DD SYSOUT=B
//FT10F001 DD DCH=(RFCRM=VSR,PLKSIZF=3240),
// SPACE=(TRK,(1,5)),UNIT=3330
//FT12F001 DD DCH=(RFCRM=SR,LRCCL=NO,PLKSIZF=900),
// UNIT=3330,SPACE=(TRK,(10,5))
//FT14F001 DD DCH=(RFCRM=VSR,PLKSIZF=3240),
// SPACE=(TRK,(15,5)),UNIT=3330
/*
/* CALCOMP PLOT TAKE
/*
//PLOT TAPE DD UNIT=2400,LABEL=(,FLP),VOL=SER=PLT1
/*
//SYSUDUMP DD SYSOUT=A
//

```

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Figure 12. - Concluded

drum plotters, the driving software is somewhat different. The two installations are characterized in Table 59.

TABLE 59. - CALCOMP OPERATION		
Facility	Hardware Identification	Software
Calac	CALCOMP 765 12-inch drum	CALAC enhanced CALCOMP software
Langley	CALCOMP 765 12-inch drum	LRC Graphic Output System

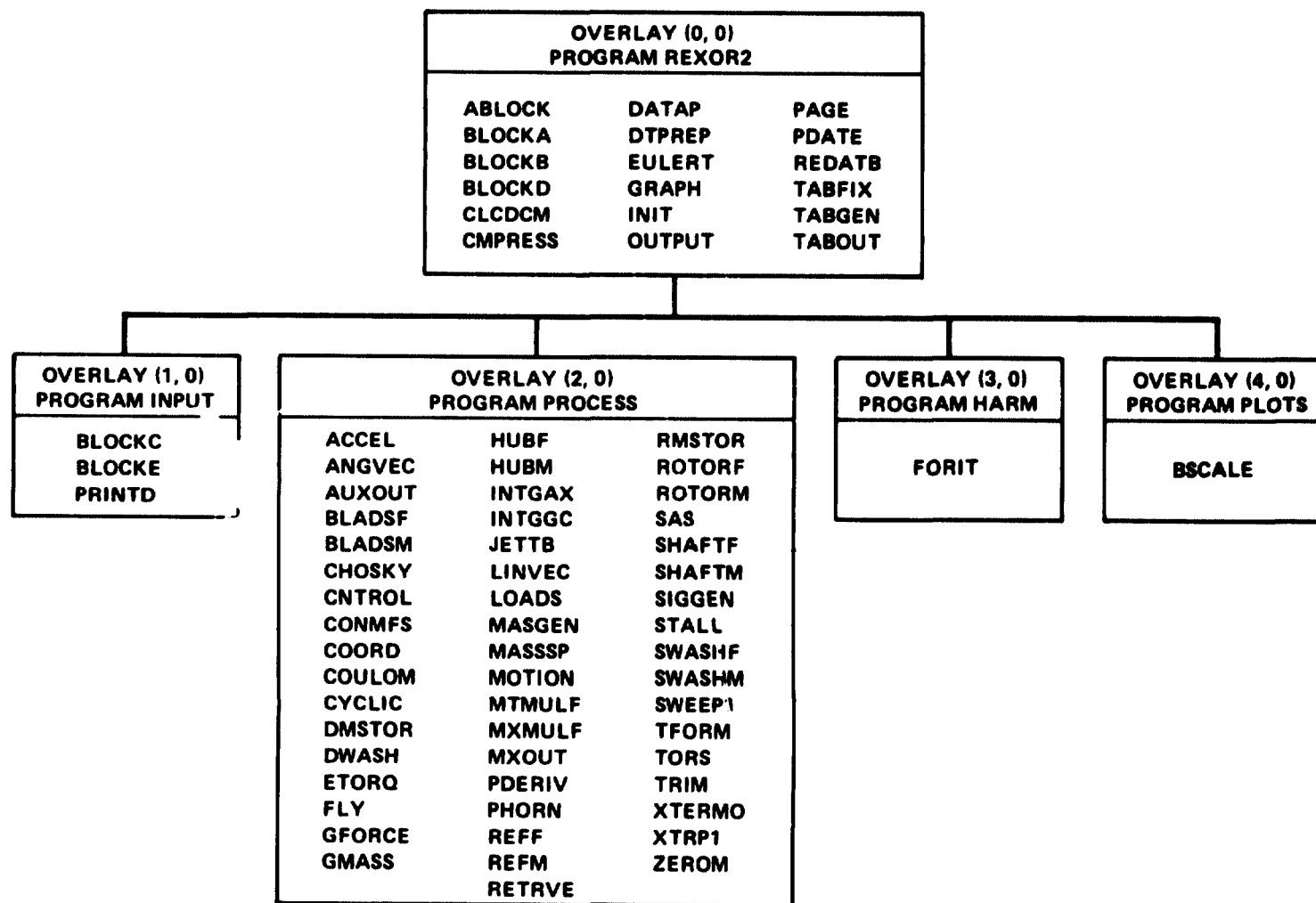


Figure 13. - CDC overlay structure

7. REFERENCE CITED

1. Davis, J.M: Rotorcraft Flight Simulation With Aeroelastic Rotor and Improved Aerodynamic Representation, Volume II - User's Manual, USAAMRDL Technical Report 74-10B, June 1974.